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Engineering News-Record

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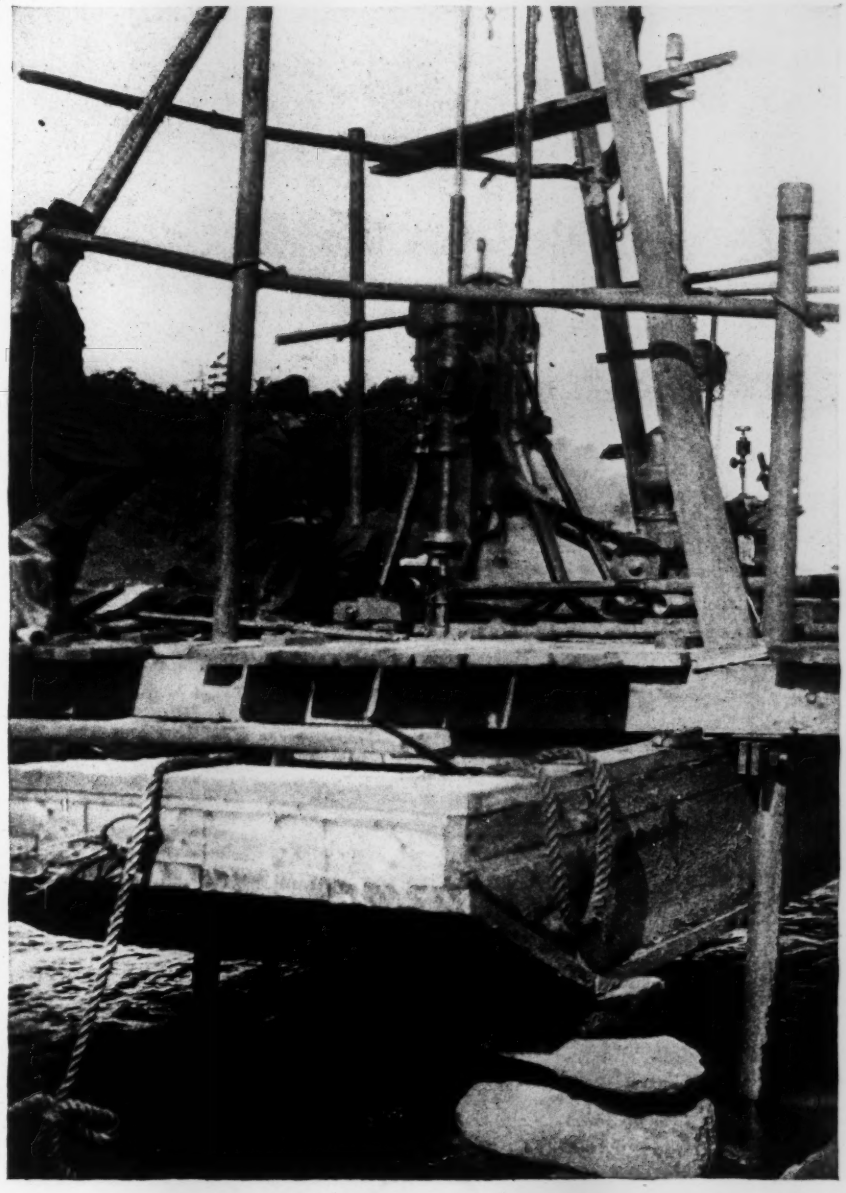

A Big Power and Irrigation Development in Palestine

Exploratory Borings for Public Works in New York City

By James F. Sanborn

From Job and Office — Hints that Cut Costs and Time

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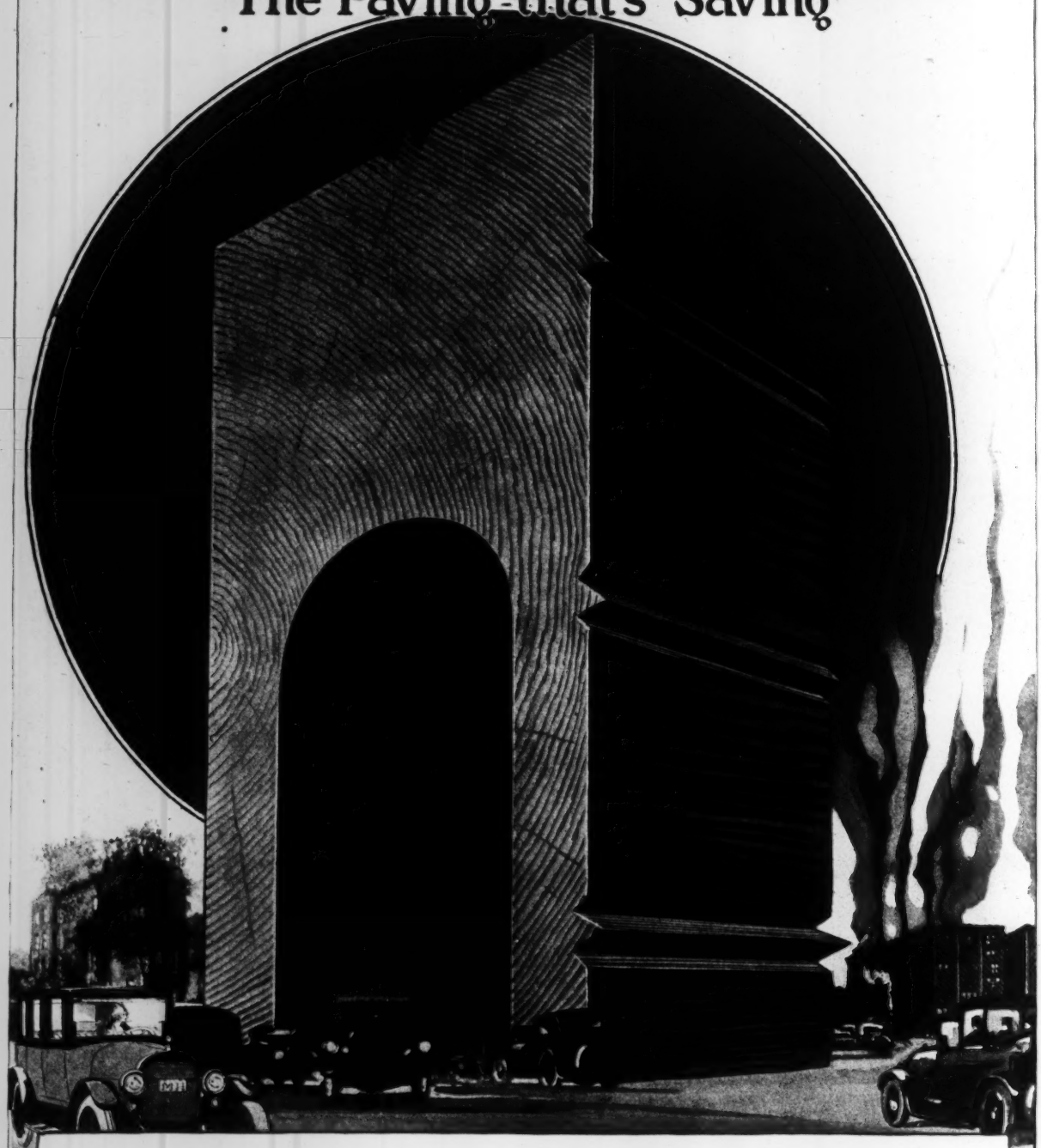

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, Editor

Volume 88 — NEW YORK, JUNE 22, 1922 — Number 25

Shingles Again Indicted

ONCE more a fire of the conflagration type has swept through a wooden house district, this time at Arverne, Long Island. Once more the charge is made that responsibility rests on the wood-shingle roofs. W. E. Mallalieu, head of the National Board of Fire Underwriters, says, "The Arverne fire is what is known as a wooden shingle roof conflagration . . . It is probable that if there had been no wooden shingle roof, the original fire would never have spread as it did." By a coincidence the issue of shingle roofs is raised on another page by R. S. Moulton, of the National Fire Protection Association, who refers to some earlier conflagrations in support of his argument. Both utterances, like most of what has been written previously on shingle-roof dangers, fail to offer any proof that wooden house colonies are not subject to substantially the same conflagration danger with or without shingle roofs, and without such proof they miss the convincing effect which they aim at. Wood-sheathed houses in the path of a blast of flame and heat are bound to become ignited and take part in the advance of a conflagration, and while it is obvious that incombustible roof coverings reduce the area of inflammable materials directly exposed to heat attack, it has never yet been shown that they would materially reduce the probable spread of a general fire. Yet Mr. Mallalieu charges the shingle roof with being the responsible cause of conflagrations in wood-house districts, saying that they have occurred "because of the wide use of such shingles for roof coverings." Only recently we commented on the absence of proof and convincing effect that has characterized much of the anti-shingle propaganda in the past. Means can be found, we believe, for providing such proof. Were the case against the shingle convincingly established, the way would be open for a definite step forward in the fire-prevention movement; and such a forward step is much to be desired.

Whither Going?

WHITHER is the Federated American Engineering Societies going? It was organized to enter into non-technical matters of public importance, and in so doing relieve its constituent members of these activities, yet at the Pittsburgh meeting of the council it refused to take membership in the American Construction Council. A short time previous, on the other hand, it had moved to help in arranging an International Engineering Congress in Philadelphia in 1926. The former is not a technical activity; the latter is. The Federation, through its council, refuses to support that for which it is organized, but promotes that for which it is not organized. The reason for refusing to join the Construction Council is beyond our comprehension. It is because the Federation "should be co-ordinate and not subordinate" to quote one speaker, or in the words of another, "if we do this [join the new organization] we shall be on the same stage with the A. F. of L. or the National Building Trades Employers Association." So the council voted to co-operate with but not to take membership in the new body. We think there is needed in the council a clearer view of its purpose and a greater sense of responsibility for carrying out that which the constituent bodies have delegated to it. There may have been a feeling that the Construction Council movement interested too limited a group of engineers to justify the Federation's participation. That might have been a good excuse, but that reason was not mentioned in the Pittsburgh discussion.

Licensing Indecision

TYPICAL of the mental attitude of many engineers is the report of the Committee on Registration of the American Engineering Council, presented in *Engineering News-Record* last week. The committee appears not to see any positive reasons for licensing but is willing to bow to an accomplished fact. It will admit that there are reasons why such legislation "may properly cover engineers and architects charged with responsibility for public works," but it is agreed that those reasons do not apply to mining engineers. As to other engineers it cannot agree. So with engineers in general. Not only do those who profess opinions on the subject disagree among themselves but many, also, cannot even lead their own minds to definite conclusions on the issue as now drawn. They feel that even now arguments have not been presented with such clear-cut precision that they are left only the alternative of support or opposition. We fear that this indecision is traceable to an opinion that much of the argument in support of licensing has been invoked to justify a position already occupied on other than strictly rational grounds. We do not question here the soundness of that argument. We point out only that so far it has failed to convince a numerous and worth-while section of the profession that engineers should be licensed by the state. And that section, by the way, is far more numerous and worth-while than might be imagined in view of the highly organized minority in favor of licensing. We suspect that where the opposition has not been similarly organized the question has been going by default. Quite aside from the merits of licensing, we believe that this is not a healthy situation. The issue is too important. Licensing will have its effect upon every engineer, and each individual engineer owes it to himself and his profession to think the subject through to a definite conclusion.

Grading Portland Cement

SOONER or later we are coming to grading cement. The present standard portland cement specification is a great step forward from the dozen different standards of some years ago but all that it does is to pre-

scribe certain universally accepted minima in place of many different minima. It perpetuates the fallacy that all portland cement is alike, or at least equally acceptable, provided it is just so good in a number of particulars. As Mr. Bates points out, in the extract reprinted on p. 1046 of this issue, cement for different uses requires different properties. At the present time there is difficulty in specifying cement qualities that will indicate those properties, and more than that tests of concrete have not been devised which unmistakably relate cement quality to concrete behavior. In consequence the single standard is today justified and desirable. The art of testing is improving, however, and these difficulties will be overcome There are some commercial reasons why one and only one cement standard should prevail but they must in time bow to superior demands of the user.

Toward a Uniform Concrete

SO PRONOUNCED has been the opposition to the Joint Committee's clause permitting the specifying of concrete by strength and so valid have been the arguments against it that there is small chance of its being incorporated in the final report of the committee. Nevertheless, with normal improvements in the making and testing of concrete a strength specification is bound to be required in time. Methods which will guarantee a uniform concrete and tests which will definitely determine that such a concrete has been produced are being studied all the time and human experience shows that when a sufficient number of men work simultaneously and independently on the same problem that problem is eventually solved. A step toward the solution of the problem of uniform production of concrete is promised in the method outlined by Mr. Bertin, of the White Construction Co., on another page. The variable moisture content of sand has been a stumbling block in proportioning ever since the importance of the water content has been appreciated. The suggested method bids fair to make it negligible, provided it can be shown that the saturated content of a given sand is constant, and provided further that enough tests prove beyond doubt that the optimum amount of water can be computed from the characteristics of the aggregate. It is to be hoped, therefore, that the contemplated tests will be comprehensive and prompt.

Dangerous "Amusement Devices"

JUST about thirty years the Chicago World's Fair gave birth to the mechanical "amusement device," which since then has come to infest every private park in the country and some public parks. During that time a record of accidents and fatalities has been piled up against these machines which characterizes them as not merely a public nuisance but a public menace. Last week a degenerate descendant of the Chicago Fair family, a small Ferris wheel, blew down in a wind storm, adding seven or eight more to the list of victims of amusement devices. It is time to put an end to this bad record. Two courses are open. If the thrill-making machines built for the alleged diversion of the working man and his family are held to satisfy a real need, they must be placed under such control, and charged with such accountability, as will assure safety. To do this, competent engineering certification of their adequacy in construction and in operation is the minimum requirement. This is the one course; could it be followed effectively and continuously, a reasonable assurance of safety might be attained. The other course is more radical but certain in its operation: Wipe out the amusement devices entirely. Under present conditions the public safety is constantly at risk while the various contraptions intended to give their patrons a new sensation continue to exist. Depending for their attraction on a spice of fictitious danger, they are so built and managed that this danger only too often becomes real. With the rarest exceptions they are incompetently designed, cheaply built, and operated by roustabout attendants. Only through a miracle can they be permanently safe; and sad experience shows that this particular miracle does not often happen. Both structural safety and operating safety are in question. Frequent competent engineering certification of the structures would reasonably assure the former. Safe operation is a more difficult problem, and nothing less than requiring skilled, licensed operators to be in charge of such devices at all times would do. We have little faith that such drastic requirements could be enforced even in cities with efficient administrative machinery. And of course those amusement machines which are located outside of cities, as many of them are, would altogether escape control unless it were exercised by the state. Complete abolition of amusement machines is the only dependable guarantee against their dangers.

Time for Performance

FOLLOWING the controversies which marked both the original and the adjourned sessions of its annual meeting, the American Road Builders Association has reached the point where promises of an alert, business-like administration, in keeping with the importance of highway development as a leading American industry, are not sufficient. The indications are clear that a substantial amount of actual performance will henceforth be demanded. Much fault has been found, in the past, with the management of the organization as exercised through the secretaryship, but in spite of this widespread dissatisfaction the former incumbent was returned to office by a vote of the directors at this year's annual meeting—not a hopeful sign. In the opinion of many the real solution lay in a thorough housecleaning —applied both to methods and to personnel. This has not been done, but there are indications that an effort will be made to improve conditions this year. It is difficult, however, to reconcile this view with the action of the directorate in casting a majority ballot which can be construed in no other way than as an indorsement of the old secretaryship.

The main hope lies in the assumption of a large portion of control over the association's policies by the executive committee. One of the big issues is the management of the Good Roads Show. So severely was the conduct of the show at Chicago this year criticized that it might be worth while trying the innovation of employing a competent, paid manager and providing him with headquarters in Chicago at least three months before the opening of the show. Such a manager could be guided as to policies by a committee representing both the active members of the association and the manufacturers. If the feeling among exhibitors is rightly sensed, they are willing, this year, to make a final trial

of participating in an exhibit in co-operation with the American Road Builders Association. It is certain, however, the the experiment will not be repeated unless the conditions of past years show a marked improvement.

With a break in the deadlock in the selection of a president effected by the choice, last week, of Thomas J. Wasser and the charge of an illegal election of directors sustained, the way is clear for constructive work instead of internal dissension. The feeling now is to let bygones be bygones. Nevertheless, the end of the year will bring forth a demand for proof that the present administration has been a decided improvement over its predecessors.

To Put Labor's Best Foot Forward

IT IS the type of leadership displayed by John Donlin, president of the Building Trades Department of the American Federation of Labor, at Cincinnati recently that will win for labor the solid support of the general public. In his annual report he laid down the principle that the aims and methods of labor organizations cannot contravene the interests of the public. Specifically he proposed (1) that the authority to call strikes be taken away from the local unions and be lodged in the central organization, (2) that unscrupulous labor leaders be deposed, (3) that periodic conferences be held between the presidents of all building labor international unions in order to deal with important issues involving procedure in the building trades, and (4) that laws and rules that are "wasteful, devoid of reason and unjustifiable" be eliminated.

We have no doubt that the adoption of these suggestions would work a reformation in the building-trades unions. It stands to reason that among a group of men big enough to have been elected presidents of their international unions enough sound leadership will be found to reject, once given the needed authority, methods and procedures which are unfair to the public and a hindrance, in the long run, to labor's attainment of its own aims. The fighting type, that knows no reason, finds its way into the higher ranks. On the other hand, that there is a goodly group of the other persuasion is shown by these proposals of Mr. Donlin and by the wholeheartedness with which the Building Trades Department has worked in the National Board for Jurisdictional Awards—that singularly brilliant example of what can be done in labor questions by a man-fashion, honest approach by all parties at interest.

Should Mr. Donlin carry his association with him in his suggestions his group will take a strategic position in the construction situation. With invincible force they could then demand that other elements in construction square their practices with the interests of the public—the dealers, for example, who have gouged on materials, the bankers who have demanded extraordinary premiums.

It is much to hope for. However, Mr. Donlin has more than once set labor's best foot forward. If his associates will join with him in demanding centralized strike control, the elimination of crooked leaders, the co-ordination of the internationals on policies that square with public interest, and the elimination of wasteful practices, results of inestimable value to the public—and incidentally to the A. F. of L.—would quickly follow.

The State at Fault

WITH great regret we record on another page an accident that on every account should not have been allowed to happen. The collapse of the Marlin bridge by washout of an abutment gives no room for apology for its inadequate construction. As an academic question of engineering, the case may be subject to argument on both sides. Rivers are treacherous, and scour action cannot always be provided against at a reasonable cost; accidents will happen, and the vagaries of floods are beyond prediction; foundations ten feet deeper might have been destroyed just as easily, and the extra burden on the taxpayer's pocket would have been a sheer waste. Reasoning of this kind may be urged in defense of the particular construction, but the unanswerable fact is that the people who depended on the bridge expected and believed it to be enduring, and had faith enough to stand on the bridge even in time of flood—they were carried down in its collapse. The public knows, and engineers know, that properly applied engineering skill could have prevented the failure.

Where impartial engineering supervision is absent, such accidents are likely to occur. They may occur even where the most conscientious and disinterested engineering skill has been applied, but long experience shows that they are most common, in fact alarmingly common, under circumstances where the engineering design, or important engineering decisions, are left to a contractor whose pocketbook benefits by building cheaply. In permitting the construction of this particular bridge without adequate, impartial engineering control, the State of Texas is at fault.

Country-wide experience points clearly to the remedy for these conditions. The remedy is to place all bridge construction in a state under the control of the state highway authorities, and to organize a competent bridge division in the highway department. State upon state has demonstrated that such control at once raises the level of highway bridge construction and removes a menace that until then resisted all attempts at betterment. So long as local bridge contracting remains in the hands of political officials the results are evil in so large a proportion of cases that the public is never safe and never well served; but the consistent record of a generation shows that the evil conditions are changed when the state highway bridge authorities are placed in control.

Texas needs to reform its bridge-building system as many other states have done. It is not the only state, however, in which the antiquated and unsafe system of bridge construction in sole charge of local officials prevails. The Marlin failure is an object lesson whose instructive value is not confined to Texas. Wherever the old system is still relied upon, the people should be told and should realize that they are in danger, that public safety is not adequately provided for, and that a change of system is needed.

Bringing about the change lies within the control of the people of the state themselves. Legislatures should act to provide for state supervision of bridge building. Until they do, it is the state that is at fault, and the state should properly bear the blame for resulting failures. This should be brought home to the people of Texas and of other states that need to learn the lesson.

Exploratory Boring Needed as Guide to Design and Construction of Public Works

Subsurface Surveys Save Money and Prevent Mistakes—Boring Methods and Drill-Rig Types Discussed —Preservation of Records Vital

By James F. Sanborn
Consulting Engineer, New York City

Mr. Sanborn was formerly department engineer on the Catskill aqueduct and took an active part in the extensive geological investigations which invariably preceded the location and design of the dams, tunnels and other structures built by the New York Board of Water Supply.—Editor.

ENGINEERS planning large works should know the nature and quality of the underground mass supporting heavy structures, information upon which the design, cost and very existence of these structures depend. The systematic survey of that portion of the earth below the visible surface is frequently of even more importance in considering large structures than the topographical surveys upon which engineers have learned to rely in the preparation and conduct of construction work. The proper method of securing underground data, however, is not always followed by those responsible for large expenditures and the tendency of many engineers to take chances that their assumptions are correct has often been followed by delays, revisions of plans and additional expense far beyond the original estimate.

THE POWERFUL MINNESOTA CHURN BUCK, SHOWN BELTED TO DIAMOND DRILL FOR INCLINED HOLE

In our large cities heavy steel-frame buildings and bridges of long span with great loads concentrated upon footings of small area, subway tunnels through water-bearing sand beneath rivers, aqueducts in rock carrying water under great pressure to the distributing mains, all require a definite knowledge, respectively, of the excellence of the material carrying the loads of columns and bridge piers, the depth of cover above the compressed-air tunnel roof, and the certainty that no failure of the rock through which the aqueduct tunnel is driven will result in serious loss of water brought from a far source.

The purpose of borings is, first, to determine the practicability of the site, perhaps one of several to be chosen for a structure, and after the best is proved, to gain the information required to assist in designing the particular type of construction and in estimating the cost of necessary excavations. Wash samples of glacial drift and rock samples in the form of cores seldom furnish, by themselves, enough information of the nature of the ground mass. A knowledge of the behavior of the drill as it is operated, the circulation or loss of water used in drilling, and subsequent tests applied to the hole after completion must all be studied to secure definite information on which to base designs for large works.

Boring Records—It has not been possible for most engineers to have a wide experience in underground exploration, nor is it easy to get much information on the subject of borings and geological structure. In such work those skilled in making and interpreting boring data should be consulted whenever possible. As an aid to those seeking information in New York City the Municipal Engineers of New York reviewed all available data on borings and geology relating to the city's public works in order that the information constantly going through the hands of the city's engineers might be preserved. A permanent collection of all reliable records of borings and a collection of rock cores and samples representing the numerous geological formations from Yonkers to Staten Island has been arranged and is housed in a room set apart for the purpose in the Municipal Building, and is available at all times for reference and study.

It is a mistake to assume that borings have but a temporary value and are useful only for the purpose for which they were made. In the investigations undertaken by the New York Board of Water Supply for the location of the 18-mile city tunnel of the Catskill aqueduct the geologists made excellent use of certain rock cores from borings made by the Dock Department many years ago and preserved by General McClellan, who insisted on saving the records and cores. Some of his associates with less imagination wished to throw the old stuff away. These very cores gave the important preliminary information which guided subsequent exploration and threw light upon the rock structure under the East River.

Borings are made for many purposes and the interpretation required varies with the needs of each case. Such works as bridge piers, building foundations, dams, caissons, docks, subways, tunnels for sewers or aqueducts and harbor dredging offer opportunities for the effective use of borings. It seems well to describe three particular cases: (1) a long tunnel in rock; (2) the site of a dam on glacial drift; and (3) a tunnel under a river. In each case the explorations were carefully and thoroughly made, were accompanied by exhaustive tests of various kinds, and furnish good examples of the best practice in work of this kind.

City Aqueduct Borings—A tunnel 18 miles in length and from 200 to 700 ft. underground, the longest con-

tinuous tunnel in the world, has been driven for the Catskill aqueduct pressure tunnel in New York City, starting in Yonkers and running to Brooklyn. As this tunnel operates under a head of several hundred feet of water the explorations were unusually thorough in order that the tunnel might be everywhere located in rock so sound that it would not yield and permit leakage in service. Numerous borings were made to define the bedrock profile along the tunnel line and to explore for bad ground in order that dubious stretches might be avoided in the location.

Devasego Dam Site—A problem in underground exploration with a number of unusual features was studied by the New York Board of Water Supply at a proposed dam site on Schoharie Creek at Devasego Falls. The site appeared at first to be the most favorable one on the stream, but after the borings and certain porosity experiments had been completed, the site was proved to have certain disadvantages which, with other considerations relating to the catchment area, determined the selection of another location for the dam. The borings were largely in glacial drift in part filled with boulders and hard clay, which made for difficult boring work, and extended to bedrock from which diamond drill cores were taken. Wash samples of the glacial drift were caught, and every 10 ft. or oftener a dry sample or undisturbed core of the glacial drift was taken, which proved of great value in estimating the porosity of the material. The glacial drift was in places so hard that an unusual amount of dynamite was required at times to gain an advance. The large number of sticks of dynamite used was taken as some measure of the impervious character of the ground.

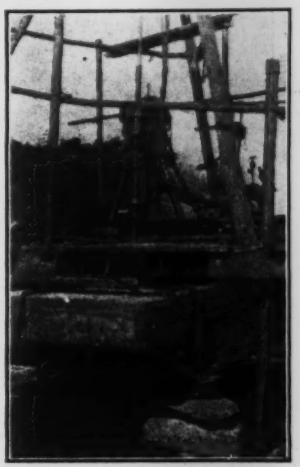
SETUP FOR WASHING AND DRIVING CASING

At angle of 60 deg. in preparation for diamond drill boring.

An unexpected bend of this old gorge almost at right angles to the course of the valley illustrates well the need of careful work in distributing the borings to establish the position of such an underground feature, which may have a serious bearing on the location of the dam foundations. At the site explored a ridge of glacial drift, extending out into the main valley from the west, formerly dammed the entire valley, forming a lake to the south. The modern stream has cut through this soft ground ridge at Devasego Falls. Borings show the drift there to be 100 ft. deep. The proposition of the engineers was to take advantage of the natural barrier of glacial drift which crosses the valley, build a short dam to close the gap made in the glacial ridge by the modern stream and thus restore the lake which formerly existed to the south of the ridge.

As the depth of water in the reservoir confined by the earth ridge would be nearly 100 ft., the main question was to determine by the borings the degree of porosity of the material in the ridge. Lines of holes were drilled along the center of the proposed dam site and along the crest and toe of the ridge, as well as across the ridge. The glacial ridge is known as a "kame deposit" and was formed close to the glacial ice during a melting stage, in part by material transported, sorted and laid down by the water from the melting of the ice mass and in part of residual till frozen into the ice, compressed by it and dropped as the ice disappeared.

It can be readily appreciated that the mixed material resulting from the activities of the water and ice might be in places quite porous, and elsewhere quite impervious, as was found to be the fact on examination of the dry samples taken at frequent intervals in the borings. The sandy, porous material and the dense impervious portions of the ridge were found to lie in no regular relation one to the other, so that it was at first hoped that there were no continuous strata of porous material extending through the ridge. A close inspection and classification of the dry samples taken from the borings seemed to show that the upper part of the ridge above the level of the floor of the valley was sufficiently impervious to act as a dike, while the material below that level was classified as easily penetrated by water. This conclusion was largely borne out by the records of loss of water during the operation of drilling at about the elevation of the valley floor and by the position of the ground-water table under the ridge, which was flat and below the general elevation of Schoharie Creek. As a confirmation of the belief that great quantities of water would escape under the ridge from a reservoir making use of the kame deposit as a dam porosity experiments were made in some of the drill holes by pumping water down the holes and noting the effect upon the water table in neighboring holes. In certain cases the water introduced went away as fast as it could be pumped in, without considerable result in raising the ground water level, which was regarded as further evidence of the porous condition of parts of the glacial ridge.



RIVER SETUP, DIAMOND DRILL MOUNTED ON SCOW

The dam is now being built about 3 miles down stream from Devasego Falls.

Hudson River Borings—About the most difficult boring work for an important structure near New York City was that undertaken to explore the bedrock of the Hudson River valley near Cornwall, N. Y., for the pressure tunnel of the Catskill aqueduct which crosses the river at Storm King mountain. The maximum depth of bedrock there is still unknown, although about two years were spent in efforts to sink casing from floating equipment in the middle of the river to develop the bedrock profile above the tunnel line. The greatest depth reached by the casing was 768 ft. but at that point the hole had to be abandoned without taking any diamond drill core from bedrock. Inclined diamond drill holes were meantime started from the deep shafts on either

shore, which demonstrated that the gorge did not extend below an elevation 960 ft. below the water surface. (See *Engineering Record*, Jan. 15, 1910, p. 68.)

A survey of the holes at the Hudson River was made to determine the inclination at 50-ft. intervals by means of glass vials etched with acid. The vial partly filled with dilute acid was placed in a tube, inserted to the desired depth in the hole, and allowed to remain until the line of the surface of the acid was etched on the glass. On being withdrawn, the angle between the axis of the vial and the etched line was measured against a calibrated dial.

A small compass, floating in a bath of hot gelatin, which solidifies on cooling, is sometimes used to determine the direction of inclined holes.

In order to check the depth of the holes below the river surface by measuring the hydrostatic head at the bottoms of the holes a recording pressure gage was used. This gage consisted of a cell with a steel diaghragm filled with mercury and a glass column through which

PERMANENT STORAGE OF CORES FOR BORING RECORDS
A 6-ft. core box, showing double layer of cores by use of trays; the core is marked by surgeon's tape, preserved by a covering of varnish.

the mercury rose and overflowed into a receptacle, the amount of mercury so overflowing being in proportion to the pressure on the steel diaphragm.

Boring Methods—The methods employed in boring work depend upon the information sought and vary from the sounding-bar or rod driven by hand to the heavy and complicated machinery necessary to handle deep holes. Four general types of machine are used for making exploratory borings for public works: (1) Wash rigs; (2) diamond drills; (3) shot drills; (4) well drills. In addition we may mention (5) the rotary and (6) the California well rig for making deep borings or test wells in soft ground. Wash drills are used to explore the soft ground above bedrock, while bedrock is explored by methods 2, 3 and 4. The drilling problem in most cases is to determine the bedrock profile, to take samples of the glacial drift or soft ground overlying the rock and to secure cores of the bedrock in order to determine its character.

Two separate drilling operations are necessary; First, carrying the casing to bedrock to support the walls of the hole in soft glacial sands and, second, taking cores in bedrock. For work of exploration the drilling rigs used are generally light, as the holes for most structures are not often deep. Drilling contractors commonly have one type of rig which they use and to which their men are accustomed so that the kind of machines used depend upon which contractor gets the work. For ordinary depth of overburden—50 or 75 ft.—the churn drilling and driving of casing can be done with the drum of the diamond drill. For greater depths, resort may be had to some form of well-drilling rig, sometimes mounted on a wagon, and provided with a boiler pump and gear for raising and dropping a string of drilling tools handling a sand bucket and for driving casing by means of a weight.

Gasoline engines are used somewhat for test-boring work where about 10 hp. is sufficient. They may be provided with a belt pulley for driving the shot or diamond drill, and a nigger-head on a flywheel for driving casing. Gasoline equipment is not satisfactory in cold weather on account of difficulty with the water supply, and more power is needed in penetrating great depths with casing than the above-described rig can furnish.

Minnesota Rig—A satisfactory type of plant adapted for penetrating 200 to 300 ft. of glacial drift with casing is the Minnesota type churn buck, shown in the pictures. Steam is provided from a boiler of about 10 hp. which may be mounted on a wagon.

The powerful steam engine of oscillating type with a 10 x 12-in. cylinder is geared to the spool which is used in driving casing. The up-and-down motion with the wash pipe or churn-drill rods and for operating the drive weight is secured through letting the rope slide back and forth tight and loose, on the spool of the engine. The engine is also belted for operating the diamond drill.

A three-legged derrick with 26-ft. poles is used, giving 22 ft. hoist in the clear. A hollow cast-iron drive block weighing about 300 lb., with a 3-in. diameter hole through the center for a guide, is used for pounding down casing. In drawing up the casing when shooting on boulders encountered in sinking the engine is well adapted to "rapping back" or delivering a powerful upward blow for withdrawing or raising the pipe. Altogether, it is a very flexible and powerful rig.

A pump of large capacity is used for supplying the plentiful volume of water under high pressure so necessary in washing down casing below the 100-ft. depth. The outfit is used as a wash rig for operating wash rods and driving casing through earth until rock is reached. In operation the engine is kept running always in the same direction while the rope for raising the rods or drive weight is operated by hand by tightening or loosening two or three coils on the drum. This machine is strong enough to part a new 1½-in. diameter Manila rope. For driving casing through earth more than 100 ft. deep it is a device of sufficient power for the rapid handling of the work.

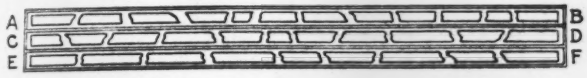
Wash Rigs—Hand-operated wash rigs are effective in putting down relatively shallow holes and where there are no boulders and the going is easy, as in uniform clay or sand, wash holes are sometimes put down by hand to depths of 200 ft. in sand. The advantage of the hand rig is that it is light and easily moved from one setup to the next, and can be taken anywhere, in woods or over hills, or where room is lacking in city work, without much expense. For preliminary work such light rigs are useful, but the results secured are of limited value. Wash borings intended to prove bedrock are likely to be unreliable, and power rigs must be employed when beds of gravel, hardpan and boulders are struck; a liberal use of dynamite to break up such obstacles is desirable.

Diamond Drills—For rapid drilling in rock to take

samples and give accurate data on the formation there is no device superior to the diamond-drilling machine. There are a number of types, the choice depending upon the depth of hole and size of core desired.

The diamond bit is in the form of an annular ring of soft steel, in which the stones are set, and the bit is screwed into a core barrel, flush with the outside. A hollow line of rods actuated by the rotating mechanism spins the core barrel and diamond bit, and feeds it forward as the diamonds wear away the rock. Water for cooling the bit and washing up the cuttings is forced by a pump down the line of drilling rods, which are thick and well made.

For explorations aiming to save the maximum amount



ARRANGEMENT OF CORES IN BOXES

of core the double core barrel has been devised to prevent revolving and the grinding action of the core.

The cost of core borings is usually four or five times as much per foot as the cost in ordinary glacial drift or other soft ground.

Shot Drills—There are several makes of drills suited for taking rock cores of sizes larger than the largest diamond drill bit in use; for plunger elevators deep holes in rock up to 20 in. in diameter are not uncommon. For use in weak rock which does not yield a satisfactory core by the diamond bit the shot drill often gives good results.

The shot drill has an annular steel cutter or bit attached to a core barrel 5 to 10 ft. long and turned by a string of rods actuated by a rotating power-driven mechanism. Chilled steel shot are fed down the hole and lodge beneath the rotating bit, which rubs them around on the bottom of the hole. These shot are hard enough to scratch glass. They vary in size from the finest dust to the size of No. 6 shot. If they are crushed, the cutting power is increased. The particles become embedded in the soft steel of the rotating bit and form an effective grinding tool. Water is fed down through the drill rods, as with the diamond drill, to wash up the rock cuttings, but the water pressure must be carefully adjusted to such a velocity that the shot are not carried away from the point of attack.

Earth Borings Inspection—The following directions may be given to one entrusted with the inspection of borings in earth, and have been used on public work:

The main object is to determine the pervious or impervious character of the material penetrated or its bearing value under load.

Record the character of material washed up; never report material as "hardpan" as this is too indefinite a term.

Record the discoloration of the water as indicating material being penetrated, especially the presence of clay which might not otherwise be indicated.

Watch for and record pockets of sand or gravel without any cementing material. In reporting sand be sure it is not gravel that has been ground fine by the action of the drill.

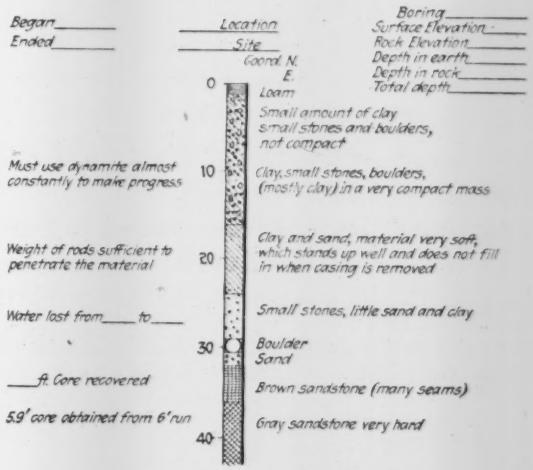
In reporting materials give some qualifications as to their compactness.

Observe the mechanical operation of drilling, giving delays and the time necessary to penetrate a stratum, omitting delays caused by other conditions than the character of the material.

Report expedients used to make progress, including the location requiring use of dynamite, with amount of same.

Watch carefully and report concisely the action of water in all boring operations. Should the water forced down the wash pipe fail to come to the surface again, the hole should be recorded as "losing water." This would tend to signify that the material is water-bearing or porous, or it may be a seam or cavity such as may exist in rock. Should the water stay at the top of the pipe it would tend to show the impervious nature of the underlying material. The water may flow out of the top of the casing, indicating that a stream of water has been encountered with a greater head than that in the pipe.

In reporting "sand and gravel," give some idea as to the proportional amounts, size, and whether or not the formation includes boulders. In the event of large boulders being encountered which cannot be "shot out" and which require the use of the diamond drill to pass through, make



TYPICAL FORM OF RECORD SHEET

sure that the location and size of the boulder is accurately determined.

Samples should be taken which will represent the character of materials for each 10 ft. penetrated, and oftener if the condition changes. The dry method of sampling is to be preferred and should be strictly adhered to for the borings at embankment sites and other places where the material arouses any suspicion of porosity. Samples should be placed in the bottles provided and labeled at once; marking the character of the samples (wet or dry) must not be neglected; label should show depth of material and boring designation. When a wet sample is permitted it should be taken only after the receptacle in which the wash water is caught is filled and all matter in suspension precipitated. A note should give the capacity of the receptacle and the progress of the boring made while it was being filled. Tests of various kinds, for bearing value of the earth, if required, may be made during the progress of the work. A correct idea of the condition may be gained by an experienced boring operator.

Rock Boring Inspection—The following instructions apply to borings in rock:

Record depth to and elevation of rock. Rock must be penetrated at least 20 ft. and attention is called to the possible error of calling boulders bedrock.

Record all observed characters of the rock, all seams and the behavior of water.

Report the comparative rates of speed of penetration through various types of rock. Racing of drill might indicate soft rock and should be noted.

Record each length of core recovered and length of corresponding run of core barrel as the proportional amounts will give indication of the hardness of the rock, consideration being given to any possible breaking up of core, due to the operations of drill or existence of vertical seams.

Records of recovered core are to be made as to whether

any of these breaks were caused mechanically or by seams.

Arrange core in boxes as shown in accompanying sketch. This work must be done regularly and boxes placed for future reference in the storage building provided. Label box with boring designation.

Preservation of Records — Mark total run of recovered core on division strips of each board. Use more than one box if necessary and give proper boring designation and number.

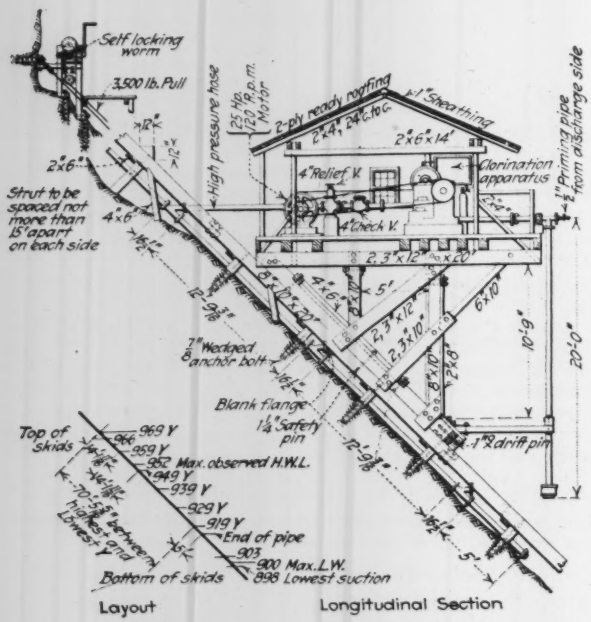
Core should be placed in the bottom of core box, as shown in sketch, as soon as it is obtained. At A place the top piece of core, labeled with hole number and depth. Then place the remainder consecutively as shown. The core at C follows that at B, while that at E follows D. The next layer is filled with core in the same manner. The core placed corresponding to A will follow core at F. After the box is filled, it should be nailed up at once for storing. In every case all pieces of core obtained from boulders and not properly relating to the core in question, should be gathered up and placed in a box made for that purpose.

For each boring the following information should be given:

Boring	Co-ordinate North	Co-ordinate East	Surface Elev.	Rock Elev.	Depth in Earth	Depth in Rock	Total Depth

Pumping Plant on Incline Moved to Suit Water Level

IN PROVIDING a water supply for the construction camp at the Don Pedro Dam in California it was necessary to make the intake adjustable to a considerable range in water level. Records of the flow in the Tuolumne River, from which the supply is drawn, show that at this point the water level has varied as much as 52 ft. As the water supply in question would be in use for more than one season, it was decided to put the pumping plant on a platform that could be moved up and down an incline as the water level varied, as shown by the illustration. Four-inch delivery pipes laid between the rails of the incline were provided with Ys for connecting with the pumping plant and were located 10 ft. apart vertically.



MOVABLE PUMPING PLANT ON INCLINE

Field-Stone Crushing Plant for Roadwork

BY CRUSHING, screening and storing rock obtained from adjacent fields, the Highways Improvement Co. of South Bend, Ind., during the winter of 1921-22, was able to get rock at a little less than it could be shipped in; was able to keep its organization together, and was able to help the farmers get rid of objectionable stone. The equipment, as illustrated, consisted of an Austin portable screening and crushing plant run by a 25-hp. steam tractor; an 18-in. x 60-ft. gasoline-driven portable belt conveyor, and a 5-ton pitless scale. The contract was for six miles of penetration macadam road near South Bend.

PLANT CRUSHES STONE FROM FARMERS' FIELDS

A survey was made of the farms along the road and it was decided that it would be possible to get enough stone from the fields to pay to put in the portable plant. The plant was set up at the middle point of the road and stone was hauled in by the farmers from within a radius of four miles. About 60 per cent of the material was taken directly from the fields to the crusher, but sometimes when the wagons all arrived at nearly the same time they were required to stock-pile the material. Most of the stone was igneous rock, basalt, granite, niggerheads, etc.

The plant reduced the stone to four sizes as follows: screenings, ¼ in. to dust; fine chips, ¼ in. to ¾ in.; coarse chips, ¾ in. to 1¼ in., and large chips, 1¼ to 4 in. As the rock was very hard the large sizes predominated. In fact the partition between the bins for the third and fourth sizes was entirely removed so that both of these sizes flowed directly to the conveyor from the screen. A 70,000-ton storage pile was built up from Jan. 10 to April 5.

The view and information are furnished by the Barber-Greene Co., whose belt conveyor was used.

Ohio Cities Cannot Divert Water Revenues

The Ohio Supreme Court has unanimously affirmed a decision of a lower court (Roetenger *v.* City of Cincinnati) upholding Section 3959 of the Ohio General Code which limits the use of the earnings of municipally owned water-works to operation, maintenance, extensions and debt charges. Cincinnati desired to transfer $500,000 of water-works revenue in relief of general taxation and of its embarrassing financial situation.

Some Engineering Aspects of New York Traffic

Counts Show Fifth Avenue Intensity—Influence of New Routes—Type and Condition of Paving Are Important

FROM a paper on "Traffic Handling," before the New York Section, Am. Soc. C. E., by Amos Schaeffer, consulting engineer to the borough president of Manhattan, the following extracts covering figures on traffic intensity and proposed measures of relieving congestion are taken:

Facilities must be provided not for the average movement of traffic over a period of 8 or 10 hours, but for a shorter interval of greatest intensity, which usually occurs between 9 and 10 a.m., and between 5 and 6 p.m. Fifteen minutes has been assumed in the past as a sufficiently short period to measure intensity.

Fifth Ave. Counts—On Dec. 21, 1910, the 15-min. period of maximum traffic on Fifth Ave. between 41st and 42nd Sts. occurred between 3:30 and 3:45 p.m., when 505 vehicles passed through the block in both directions. This is very closely 7 per cent of the total traffic in 10 hours. Fifth Ave. has a roadway width of 55 ft., permitting the movement of six lanes of traffic provided no vehicles are parked along the curb. As soon as moving traffic requires the space, no parking should be permitted. The movement of six lanes of traffic gives an intensity of 5.6 vehicles per minute per lane.

On Aug. 25, 1911, there was a maximum traffic of 256 vehicles in 15 min. between 4:45 and 5 p.m., equivalent to 2.9 vehicles per lane of traffic per minute. This great decrease in traffic is probably due to the season of the year when it was taken. The former count was in December when Christmas shopping was at its height, while the latter was made in August, when many people were away.

On April 2, 1919, the intensity was 6.19 vehicles per lane of traffic per minute. In October of the same year it was 6.96, and in April, 1920, it was 6.45. If it be assumed that there is a line of parked vehicles along each curb, which happens to be the case at times, these figures will become 9.29, 10.47 and 9.67. Several years ago it would have been asserted that no roadway could accommodate this intensity.

New Route's Influence—Traffic counts were made in April and October, 1919, in the vicinity of Fifth Ave. and 42nd St. to determine what effect the opening of the Park Ave. viaduct would have on the movement of traffic in the vicinity. These observations were made to determine the movement of northbound and southbound traffic at Fifth Ave. and 42nd St.; on Madison Ave. between 41st and 42nd Sts., and between 42nd and 43rd Sts.; on 34th St. between Fifth and Park Aves.; on Park Ave. from 34th to 35th Sts., and on the Park Ave. viaduct. The April count was made just before the viaduct was opened and that in October about six months after. Some interesting facts were developed in these counts. For instance, the total traffic on Fifth Ave. for a period of 11 hours in April was 18,617 vehicles; in October it was 17,782, a decrease of about 4 per cent. On the other hand, the maximum hourly traffic had increased from 2,165 in April to 2,511 in October.

Madison Ave. between 41st and 42nd Sts. accommodated 9,489 vehicles in April, and in October 7,710, a decrease of about 18 per cent. Thirty-fourth St., between Fifth and Madison Aves. carried 4,182 vehicles in April, and in October 4,105. Between Madison and Park Ave., however, there was an increase from 1886 vehicles in April to 5,728 in October, an increase of 3,842 vehicles, or 200 per cent. The traffic on Park Ave. from 34th to 35th Sts. increased during the same period from 5,365 vehicles to 14,376 vehicles, or 9,011 vehicles, which is equivalent to 168 per cent. The Park Ave. viaduct was not open in April but in October it carried 13,086 vehicles. The maximum hourly count was 2,098 vehicles which gives an intensity of 8.74 vehicles per lane of traffic per minute. This is a greater intensity than occurs on any of the other thoroughfares under discussion, if the intensity is based on the full width of the roadways and nothing is deducted for parking space.

The deductions to be made from these observations is that traffic immediately availed itself of the Park Ave. viaduct and the roadway around the westerly side of the Grand Central Station. There is no interference from crosstown traffic between 40th and 45th Sts., and consequently there is more freedom of movement than on any of the other thoroughfares. While it seemed to have caused but little reduction in traffic on Fifth Ave. there was considerable reduction on Madison Ave. It also appears that it must have attracted considerable traffic from other thoroughfares. The phenomenal increase in traffic on 34th St. between Madison and Park Aves. and on Park Ave. seems to indicate that a new thoroughfare for traffic has developed on Madison Ave. from 23rd to 34th Sts., through 34th St. and Park Ave., over the Park Ave. Viaduct and up Park Ave. This course certainly avoids the great point of congestion at 42nd St. and Fifth Ave.

Suggested Remedies—Studies have also been made for eliminating the grade crossing at 42nd St. and Fifth Ave. There is sufficient clearance over the subway at Fifth Ave. to depress 42nd St., so that both the surface cars and vehicular and pedestrian traffic may be carried under Fifth Ave.

It has been the practice in Manhattan for a number of years to replace curb intersections having a radius of 6 ft. by a radius of 12 ft. This permits traffic making a right turn to hug the curb closely and keep out of the way of traffic moving in the opposite direction. With a 6-ft. radius automobiles are thrown well into the way of traffic in the opposite direction. A passenger car can turn in a radius of about 20 ft. A 12-ft. curb radius plus the width of the car makes about 17 ft., so that a car after having turned a corner is not more than 3 ft. from the curb. These changes are made in connection with the repaving of streets.

Car Tracks and Paving—The effect of surface car tracks and pavements on traffic is clearly indicated in traffic observations made in 1915, on Center St. between Duane and Pearl Sts. and on Fourth Ave. between 20th and 21st Sts.; both of these streets have car tracks. On Center St. the pavement consisted of rough granite blocks and the observations indicate that vehicular traffic used the car tracks, at least to as great an extent as the pavement outside of the tracks. On Fourth Ave., on the other hand, where the pavement was a high-class granite block, vehicles used the pavement in preference to the car tracks. Two deductions may be made from these observations, namely, that vehicles will not use the car tracks unless the pavement in the roadway is bad and that therefore surface car tracks are an impediment to traffic and reduce the effective width of the roadway for vehicular traffic.

There are, generally speaking, but two kinds of pavements in use in the Borough of Manhattan, sheet asphalt and granite block. Sheet asphalt is used where a noiseless and cheaper pavement is desired for traffic of light tonnage and granite block is laid for the use of both of heavy tonnage and intensive traffic. The specifications under which granite blocks are laid at present produce a pavement which is not objectionable for the use of pleasure automobiles. The objection as to noise also disappears, as more vehicles are equipped with rubber tires. It may be predicted, therefore, that the use of granite block for pavements will increase and will be acceptable to all kinds of traffic.

Tire Widths and Vehicle Loads—A Correction

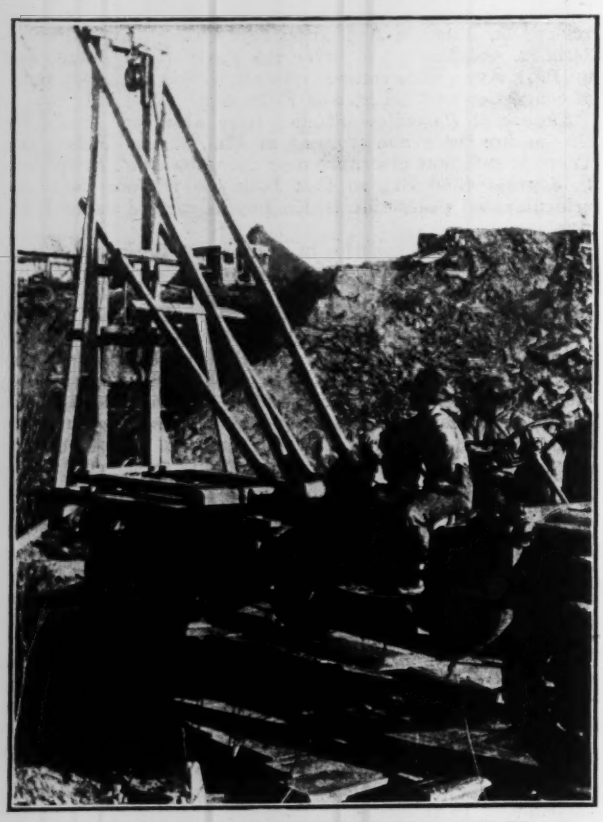
In the communication from S. Whinery on the relation between wide tires and excessive vehicle loads (*Engineering News-Record*, June 1, p. 923) two typographical errors occurred. In the sketch the width of the bearing area given as 15 in. should be 17 in. and in the text the figure "12.2 per cent" given as the increase in circular bearing area on sub-foundation should be 122 per cent.

FROM JOB AND OFFICE

Hints That Cut Costs and Time — *For Contractor and Average Engineer*

Truck Drives Piles and Backfills Trench

IN BUILDING 72 and 84-in. segmental block sewers at Wichita Falls, Tex., a motor truck was successfully utilized to backfill trench and drive piles when it was not busy hauling material. For backfilling, a winch was installed to pull a two-man scraper. The equipment,



MOTOR TRUCK EQUIPPED TO DRIVE PILES

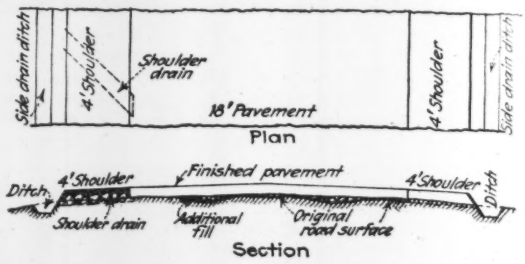
besides the winch, for piledriving, is indicated by the illustration. The contractor was C. H. Foley, Wichita Falls, and Julian Montgomery, now of the firm of Montgomery & Ward, consulting engineers, was city engineer.

A Cheap Form of Road Drain

BY JOSEPH BLICKENSDERFER
Engineer, Department of Roads and Bridges, Salt Lake County, Utah

IN THE case of a road with a grade exceeding 2 per cent the following method of subgrade drainage is effective and cheap in construction cost: At intervals of 25 ft. along the roadway small trenches should be dug about the width of two ordinary shovels and to a depth of about 2 in. below the finished subgrade, so that water collecting at the edge of the pavement will readily drop into these trenches and be carried off. In the bottom of these trenches boulders and rocks from 4 to 6 in. in size should be laid and filled in with smaller material, as the trench is filled, to within about 2 in. from the surface of the pavement. Then additional material to finish the shoulders should be put on and thoroughly rolled with a heavy roller.

For the purpose of getting the drain to function



SECTION AND PLAN OF INEXPENSIVE ROAD DRAIN

properly its center line should be at an angle of 45 deg. with that of the longitudinal axis of the road and a slope of at least 6 in. in 10 ft. should be given to the drain. The cost of this construction will be found very low where proper material is available. A plan and cross section of this type of construction is shown.

Analysis of Formwork for Concrete Members in Steel Building

BY RICHARD P. WALLIS
The Lundoff Bicknell Co., General Contractors, Cleveland, Ohio

IN A LARGE building with many concrete members it is possible to reduce mental and physical labor incident to the sketching of formwork details by the compilation of charts showing all possible sizes and arrangements of structural members and the necessary dimensions of forms to fit each case. In this way endless repetition of calculations is eliminated and the process is simplified to one of making an analysis of the particular conditions existing with any one member and then applying the proper dimensions for the parts as obtained from the charts.

The accompanying charts were prepared and used by the writer with considerable success in sketching the forms for the fireproofing of the beams and columns of the 21-story office building recently erected in Cleveland for the B. F. Keith interests. In this case the framework was of structural steel, fireproofed with 2 in. of concrete. The floor construction was principally of metal domes and concrete joists with some monolithic slabs. The formwork for the slab and beam sides was of $\frac{7}{8}$-in., and the beam bottoms of $1\frac{3}{4}$-in. material. Columns were formed from $1\frac{3}{4}$-in. material.

In the preparation of the beam sketches it was found that the depth of the steel below the top of the slab and the thickness of the floor construction were the governing factors. As indicated by the sketches, charts were worked out for the following requirements: Width of beam bottoms, depth of beam sides, size of notches in beam sides caused by other beams framing into them and notches in column forms where floor beams frame into the column.

Beam Size, In.	Weight Per Ft., Lb.	Full Width, In.	½ Width, In.
8	18.0	8	4
10	25.0	8¼	4⅛
12	31.5	9	4½
15	42.0	9½	4¾
15	60.0	10	5
18	55.0	10	5
20	65.0	10½	5¼
20	80.0	11	5½
24	80.0	11	5½

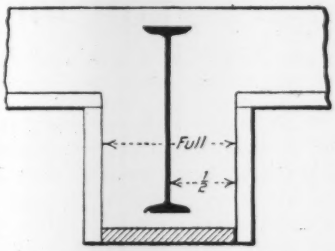


CHART I. WIDTH OF BEAM BOTTOMS

Beam Size, In.	Depth of Steel (In.)	
	—4	—2
8	15¾	13¾
10	17¾	15¾
12	19¾	17¾
15	22¾	20¾
18	25¾	23¾
20	27¾	25¾
24	31¾	29¾

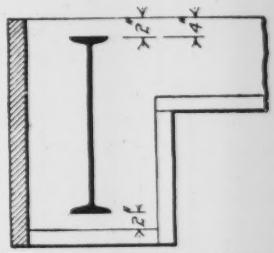


CHART III. DEPTH OF SIDE TO TOP OF SLAB

Beam Size In.	Total slab thickness in inches												
	4	5	6	7	8	9	10	10	11	12	12½	13	14	15
8	10¾	9¾	8¾	7¾	6¾	5¾	4¾	4¾	3¾	2¾	2¾	1¾	¾	
10	12¾	11¾	10¾	9¾	8¾	7¾	6¾	6¾	5¾	4¾	4¾	3¾	2¾	1¾
12	14¾	13¾	12¾	11¾	10¾	9¾	8¾	8¾	7¾	6¾	6¾	5¾	4¾	3¾
15	17¾	16¾	15¾	14¾	13¾	12¾	11¾	11¾	10¾	9¾	9¾	8¾	7¾	6¾
18	20¾	19¾	18¾	17¾	16¾	15¾	14¾	14¾	13¾	12¾	12¾	11¾	10¾	9¾
20	22¾	21¾	20¾	19¾	18¾	17¾	16¾	16¾	15¾	14¾	14¾	13¾	12¾	11¾
24	26¾	25¾	24¾	23¾	22¾	21¾	20¾	20¾	19¾	18¾	18¾	17¾	16¾	15¾

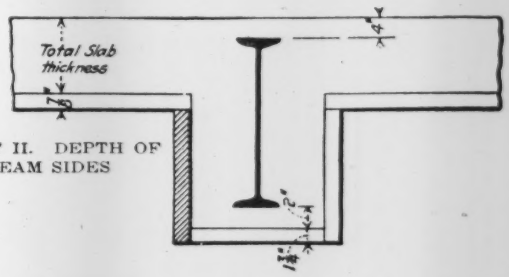


CHART II. DEPTH OF BEAM SIDES

Beam Size, In.	Depth of Steel (Inches)	
	—4	—2
8	13¾—x	11¾—x
10	15¾—x	13¾—x
12	17¾—x	15¾—x
15	20¾—x	18¾—x
18	23¾—x	21¾—x

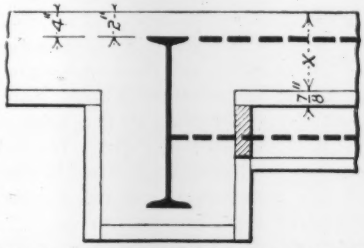


CHART IV. DEPTH OF NOTCH TO UNDERSIDE OF FLOOR

Beam Size, In.	Depth of Steel (In.)	
	—4	—2
8	14	12
10	16	14
12	18	16
15	21	19
18	24	22

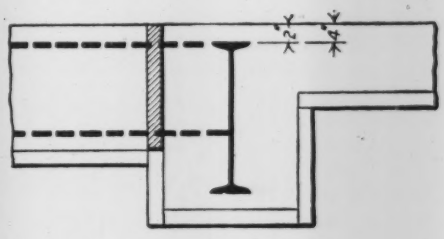


CHART V. DEPTH OF NOTCH TO TOP OF SLAB

In this particular instance the size of the steel beams and columns governed the dimensions of the forms but the principle of reducing all possible conditions of construction to tabular form and taking off the required dimensions from these charts applies equally well to any reinforced-concrete structure.

The sketches should be made in duplicate on cross-section paper (the original to go to the carpenter and the carbon to be kept in the office) and need be diagrammatic only. It is not necessary to make the sketches to scale though it would be helpful if it were practical to do so. The sketch should show a cross-section of the completed form properly oriented, indicating how the various parts are membered up, and an outline of each part carefully dimensioned so that the carpenter need waste no time in laying out the form work.

The use of these charts makes possible a considerable saving in the time required for this work and insures additional accuracy in the sketches themselves owing to the elimination of the repetition of a large number of individual calculations.

(In Inches)

Beam Size, In.	(a) 10½ in. Pan & Joist		(a) 12-in. Slab		(a) 6-in. Slab		(b)
	—4	—2	—4	—2	—4	—2	
8	2½	½	1½		7½	5½	8
10	4½	2½	3½	1½	9½	7½	8½
12	6½	4½	5½	3½	11½	9½	9
15 (42.0 lb.)	9½	7½	8½	6½	14½	12½	9½
15 (60.0 lb.)	9½	7½	8½	6½	14½	12½	10
18	12½	10½	11½	9½	17½	15½	10
20 (65.0 lb.)	14½	12½	13½	11½	19½	17½	10½
20 (80.0 lb.)	14½	12½	13½	11½	19½	17½	11
24	18½	16½	17½	15½	23½	21½	11

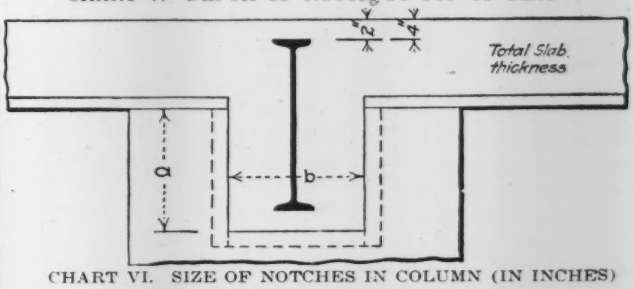


CHART VI. SIZE OF NOTCHES IN COLUMN (IN INCHES)

Paving Costs for Different Types

Average costs per square yard of various types of paving for country roads have been compiled by the U. S. Bureau of Public Roads. The figures cover 68,000,000 sq.yd. of paving constructed with federal aid in all parts of the United States during the period 1916-1921. The costs per square yard are as follows: Sand-clay, 18c.; gravel, 46c.; plain and surface-treated macadam, 95c.; bituminous macadam, $2.10; bituminous concrete, $2.50; plain cement concrete, $2.57; reinforced-cement concrete, $2.74; and brick, $4.10. These figures cover only the cost of the paving; they do not include the cost of grading, and officials point out that it must not be assumed that roads of the several types can be constructed in any locality at these figures. For example, the cost of bituminous concrete varied from $1.70 in the New England states to $3.13 in the group of states including Kentucky, Tennessee, Mississippi, and Alabama.

Derricks Lashed to Building Columns in Restricted Operating Area

LACK of sufficient operating space in which to follow the usual method of foundation excavation led the contractors on the construction of a seven-story building being erected on 43d St. between Madison and Park Aves., New York City, to adopt rather unusual means for anchoring the stiff-leg derricks necessary for handling excavated material.

The building under construction is one which will be occupied exclusively by Charles & Co., now occupying part of the building adjacent to that being constructed. The ground area to be occupied by the building has a frontage on 43d St. of 42 ft., a depth of 100.5 ft. on the west side perpendicular to 43d St. and a width of 24.7 ft. at the rear end. In order to provide room for a basement and sub-basement it has been necessary to excavate approximately 3,300 cu.yd. of solid rock. As the building is being constructed in one of the most congested portions of the city, the amount of plant that could be erected in the street was limited. Not enough room was available for erecting stiff-leg derricks in the ordinary fashion so the contractors undercut the foundations of the adjoining buildings sufficiently to provide safe bearing for heavy timbers upon which the stiff-leg derricks were to be placed. These timbers were usually 14 in. square and they were placed three ply on about 18-ft. centers.

DETAIL OF TIES FROM DERRICK MAST TO COLUMN

As these timbers were placed at approximately the finished first floor elevation, the usual cribbing necessary for supporting excavating plants was done away with, allowing free access at all times to the entire area to be excavated.

In place of anchoring the derrick masts to dead-men the derricks were so set that the masts were directly opposite and about 8 ft. from the steel columns of an adjoining 20-story building. A rigid connection was made by an 8-in. channel and two sets of 8-in. angles from the top of the mast to the steel column. The column was punched for the purpose and the angles securely bolted both to the connecting channel and to the column. Two other anchorage points were made from each mast to the adjoining columns on either side by several strands of ¾-in. steel cable, the fastening to the column being made by a steel plate and an eye-bar.

FROM JOB AND OFFICE

Hints That Cut Costs and Time

With this derrick equipment it was possible to handle excavated material by the second derrick from the rear of the area being excavated to approximately the middle of the area whence the load would be picked up by the first derrick and transferred to trucks waiting in the street. The center of the first derrick was approximately 18 ft. and the center of the second derrick 35.5 ft., from the 43d Street building line.

Derrick 1 was equipped with a 60-ft. boom and a 35-ft. mast and derrick 2 with a boom about 75 ft. in length and a mast 35 ft. long.

The excavation work was done by Clarence L. Smith, Inc., New York City, and the Ruggles-Robinson Co., engineers and constructors, are contractors for the erection of the building.

Floating a Stranded Lumber Carrier

BY E. A. STRUNK, JR.
Key West, Fla.

AN AIR compressor, a gasoline launch, some light derrick equipment and a modicum of ingenuity were largely responsible for the reclamation of 75 per cent of the 600,000 ft. b.m. lumber cargo carried by the American schooner "J. W. Somerville," which was stranded last October in the Gulf Straits between Key West and the coast of Cuba. The schooner was en route from St. Andrews Bay, Fla., to San Juan, Porto Rico, and was overturned during a West Indian hurricane. All members of the crew were lost. The vessel was later found and towed into the outer harbor of Key West and grounded on a sand and coral reef of about 18 ft. depth.

Four months later it was sold and the purchaser immediately contracted to have the vessel floated, the South Florida Contracting & Engineering Co. being given the job. The schooner was located five miles off Key West and had been forced by the heavy seas higher on to the reef.

The contractor rigged up a small barge with an air compressor and towed it to the wreck with a small launch. Previous investigation had disclosed the fact that heavy anchors and the anchor chain were caught on the rock, and weighed the schooner down so that their removal was necessary before the vessel could be floated. During March and April the anchors and chains were therefore removed, considerable time being consumed in that operation due to the fact that diving was possible only in calmest weather.

With anchors and chains removed air was pumped into the vessel until it floated. The schooner was then towed into land and a rock bin built on her keel. Into this rock bin were placed 100 tons of rock which gave a center of buoyancy permitting turning of the vessel by light derrick equipment. She was then towed into water of a 35-ft. depth and a 10-ton derrick barge hooked on turned her in a few minutes. Gasoline tugs then towed her to dockage in Key West.

Heavy seas and grinding on the rocks had torn away masts and housing but all of the lumber cargo stored below decks (approximately 475,000 ft. b.m.) remained intact though watersoaked, discolored and covered with mud and sand. The hull, of edge grain pine and oak, appeared but little damaged.

FROM JOB AND OFFICE

For Contractor and Average Engineer

Solving a Land-Subdivision Problem

BY EDWIN P. ARNESON
San Antonio, Texas

AN UNUSUAL problem in land subdivision arose out of the decision of seven Mexican heirs to cut up a tract of land already long and narrow into seven still narrower strips, all of the same area. The fact that the proposed method of subdivision appeared freakish and as against public policy to the surveyor was beside the point, inasmuch as he was told that it was his services as a surveyor that were wanted, not his ideas of rural economy.

The land lay in the shape of a quadrilateral, about ten times as long as it was wide, and no two sides were parallel. It was the desire of each of the owners to have an equal front on the road along the east boundary, then to have rays departing therefrom on such

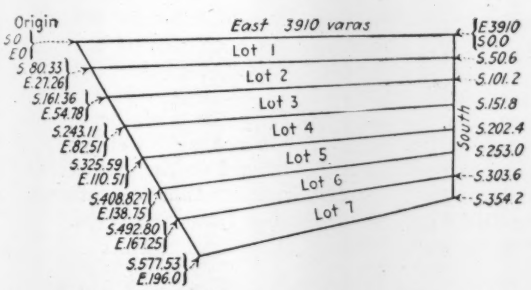


FIG. 1—CO-ORDINATES OF LOT CORNERS DETERMINED

courses as would make seven equal lots. The following solution of the problem is direct, exact and self-checking. There is nothing unusual in the mathematics of the method, but it is believed that the method itself is interesting and that it can be applied often with profit to the solution of a wide range of subdivision problems.

Briefly, if we solve the first lot, and then solve a quadrilateral equal in area to the first lot plus the second lot, we can then, by differences, find the characteristics of the second lot; and so on through all seven solutions. Though this method has the appearance of "the long way 'round," it has the advantage of working each computation on the same base. If then the differences check, first and second, we have avoided errors that might otherwise have nullified a whole series of computations.

Referring to Fig. 1, let

a=given front on road for one or more lots
A=given area of one or more lots, in acres (5,645 square varas=1 acre)
X=the latitude of west boundary line for corresponding A

Then: $$5{,}645A = \frac{(a + x)\ (3910 - x, \tan \Theta) + x^2 \tan \Theta}{2}$$

From which:

$$X = \frac{11{,}290\ A - 3910\ a}{3910 - 0.339\ a}$$

By inserting in the last expression values for A and a corresponding to the number of equal lots desired to include in the computation we arrive at the data given in the accompanying table. From these data the co-ordinates of the various lot corners are determined. By simple computations the co-ordinates will give the courses and distances desired.

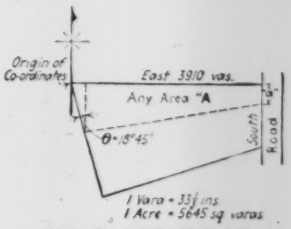


FIG. 2—DETAILS OF PROBLEM

Number of Portions or Lots	AREA: Acres	FACTORS USED IN FORMULA: "a" Southing or Latitude	(3910) (a)	(0.339) (a)	(11290) (A)	CO-ORDINATES, WEST LINE: "x" Southing	Easting x tan θ
1	45.22	50.6	197,846	17.15	510,533.8	80.33	27.26
2	90.44	101.2	395,692	34.30	1,021,067.6	161.36	54.78
3	135.66	151.8	593,538	51.46	1,531,601.4	243.11	82.51
4	180.88	202.4	791,384	68.61	2,042,135.2	325.59	110.51
5	216.10	253.0	989,230	85.77	2,552,669.0	408.82	138.75
6	271.32	303.6	1,187,076	102.92	3,063,202.8	492.80	167.25
7	316.53	354.2	1,384,922	120.07	3,573,736.6	577.53	196.0

Glass and Fire Tile Used as Aggregate in Concrete Building Foundation

BY FRANK F. ROYAL
Indian Head, Md.

WASTE glass and fire tile were used as aggregate for the concrete in a foundation for an addition to the existing office building occupied by the L. E. Smith Glass Co., Mt. Pleasant, Pa. It often happens that a glass tank built of brick and lined with fire tile breaks open and leaks or burns out with the extreme heat. In order to repair the tank the fires must be killed as the molten glass cannot be drained off. Once the glass has become cold a solid mass remains that has to be broken up with sledges, bars, picks, etc. As the glass clings to the fire tile the tile also has to be removed. Inasmuch as a quantity of this material was on hand, and because considerable difficulty would have been experienced in securing other suitable material, it was decided to use the broken glass and fire tile.

In the concrete, the lumps of glass and fire tile were broken to about 1½ in. in size. The concrete was mixed in the proportion of one part cement, two parts sand and five parts broken glass and fire tile. The wall had a thickness of 12 in. and was carried to a depth of 9 ft. The footings under the wall were composed of the same material. No reinforcing was used. After the forms were removed it was evident that the concrete used made a very substantial wall.

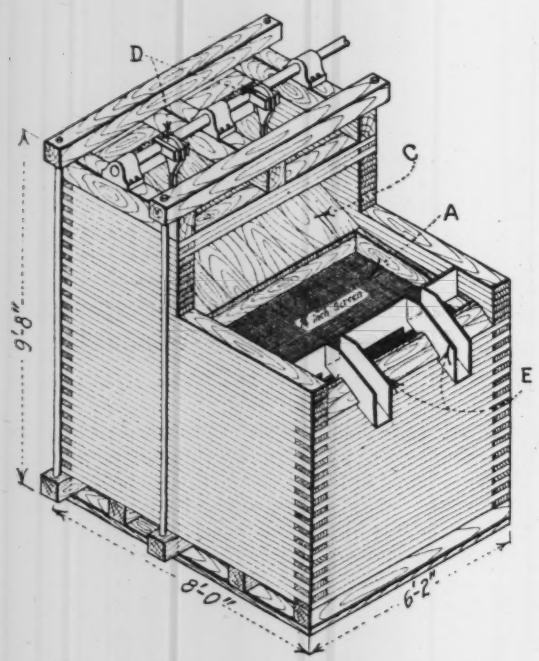
Another feature of the building was the imitation rock face finish. The walls above the foundation were built of 8-in. x 12-in. x 12-in. hollow tile and a rock facing of cement was applied directly on the blocks to match the old building, which was built of stone with a rock face finish. The cement rock facing was applied as follows:

A scratch coat of 1:2 motar ½ in. thick was put on and before the cement set the joints were marked off to match the joints on the old building and then tuck pointed. Before the scratch coat had thoroughly dried the rock facing was finished. The mixture of one part cement and one part sand with about 10 per cent of lime putty was applied with a small trowel.

Shale Removed from Gravel by Jigging

GRAVEL containing shale has been successfully prepared for concrete-road construction by jigging out the soft and light stone, in experiments conducted by the Minnesota Pipe & Tile Co., with the aid of Prof. F. C. Lang and Prof. Davis of the University of Minnesota. Using the jig illustrated as designed by Prof. Davis, "practically every particle of shale was successfully removed" from a local gravel unfit for concrete roadwork because of its shale content.

Describing the jig in the Minnesota *Techno-Log*, Prof. Lang states that it is about 6 ft. wide, 8 ft.



JIG FOR REMOVING SHALE FROM GRAVEL

long, and 9 ft. 8 in. high. The space, *A* about 4 x 5 ft. has a ¼-in. screen at the bottom. Across the front is a weir about 4 in. above the screen bed. Approximately 4 in. from this a metal plate extends across the space with openings into spouts. The openings into the metal spouts *B* are about ½ in. above the top for weir across the front. At *C* is a platform sloping toward screen and at *D* are connecting rods which operate pistons.

When the jig is in operation, the bed is filled with gravel up to and somewhat above the elevation of the weir; it is filled with water up to the same level. The pistons, which are about 26 in. x 32 in. make about 154 2-in. strokes per minute. The effect is to keep the gravel jumping with the pulsation of the water, which causes the heavier stones to settle and the lighter particles or shale to come to the surface. Then if a constant stream of water is entering the jig and also a constant supply of gravel is being furnished on the sloping platform, it is entirely a matter of adjustment to have the shale and water flow out of the spouts and pebbles, and of course water, flow out under the plate and over the weir. Sand below ¼ in. goes through the screen and is removed from bottom of the hopper. The jig has a capacity of about five tons an hour.

FROM JOB AND OFFICE

Hints That Cut Costs and Time

Tank of 40,000-Gal. Capacity Supported by Timber Bents Moved on Flat Cars

A 40,000-gal. conical-bottom water tank was recently moved from its position along the lines of the Canadian National Railways at Resplendent, B. C., Canada, to Red Pass Junction, a distance of two miles, by an unusual method which proved successful.

The method used was as follows: Two steel flat cars were first heavily loaded with ballast and spurred out, one on each side of the tank, until the drawbars of the cars were just clear of the tank's riser pipe. The tank was then jacked up about 20 in., enough to allow the track to be connected under the riser pipe and also to give sufficient clearance between it and the top of the rail.

Two timber bents were then erected, one on each of the flat cars at the ends nearest the tank. The bents were placed just inside the tank columns and the whole structure was thus supported. Bents tied together at the top with two 8-in. by 8-in. timbers, notched over the tank and bolted, one on each side of the tank bottom. The weight was distributed on the bents by short posts placed on top of the bents just back of the columns, the top ends of the posts wedging against the bottom of the tank. The bents were well sway braced in both directions and bolstered on the cars with a 2-in. pin through the center, in order that the cars might be free to swing when passing through curves.

TANK JACKED ON FLAT CARS

The cars were then coupled with chains and turn buckles, one on either side of the riser pipe, the turn buckles being used to adjust the chains when going around curves. A floor of 3-in. planks was laid in the bottom of the riser pipe and about 3½ yd. of gravel deposited in the heating chamber to act as ballast. Four sets of rope falls were used for guy lines extending from the top of the columns to the sides of the flat cars. These were fastened about 15 ft. from the end of the cars and crossed, as illustrated, in order that they might guy the tank in both directions.

On reaching the destination, the cars were again spurred directly over the new tank foundation and the tank jacked into place. No sign of damage was detected in moving the tank.

The material contained in the foregoing article was taken from the *Water Tower*, published by the Chicago Bridge & Iron Works and the Horton Steel Works Ltd., of Canada.

FROM JOB AND OFFICE

For Contractor and Average Engineer

Blower Removes Excess Fine Material From Sand For Road Work

BY ALLEN P. CHILD
Kansas City, Mo.

A FIELD blower plant proved successful in preparing bank sand for concrete-road construction in Imperial County, Cal. The local sand contained about 15 or 20 per cent of a material which would pass a 100-mesh sieve as against the required 5 per cent. Instead of importing material from other localities a special plant was erected for blowing the fine particles from the sand.

The device was an ordinary conveyor which lifted the sand to a revolving screen. Material which would pass a ¼-in. mesh was discharged into a hopper under the screen and then through a narrow opening into a storage bin below. In falling from the hopper to the bin below this sheet of sand passed in front of a nozzle through which a current of air from a centrifugal

SAND SCREENING PLANT WITH BLOWER

blower passed. The velocity of the air at the nozzle was controlled by a pressure-regulator at the blower so that any desired percentage of material could be blown from the sand. The engine, which operated the conveyor and revolving screen operated the blower.

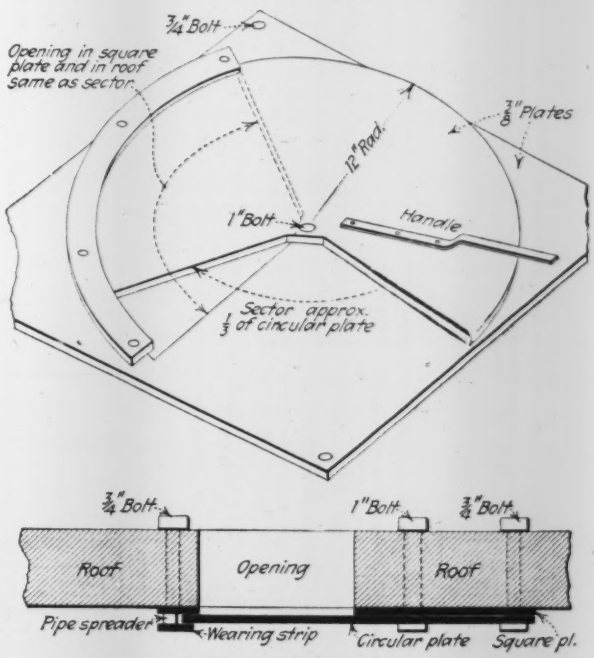
This system was economical where the sand did not require artificial drying.

An Inexpensive Overhead Bin Gate

BY G. W. MCALPIN
Huntington, West Va.

THE OVERHEAD bin gate shown in the accompanying sketch is being successfully used by various sand and gravel plants in this vicinity for admitting either sand or gravel from overhead bins into trucks. The gates are usually fitted into the roof of a tunnel through the bins. Trucks, passing through the tunnel, receive their loads.

The gate is made of a plate of ⅜-in. iron fitted against the roof of the tunnel, and held in place by four bolts.



BIN GATE FOR LOADING AGGREGATE

Gravel passes through an aperture in this plate, corresponding to a similar one through the top of the tunnel. A circular plate having a sector cut from it fits against this first plate and moves on a 1-in. bolt passing through its center. The sector fits the aperture in the ⅜-in. square plate and when turned by a handle opens the gate. A wearing strip bolted to ⅜-in. plate assists in holding the circular plate while the latter is being turned.

These gates have been made by local metal workers for about $10 each, considered a reasonable price. They are simple of design and easy of operation.

Stone Production During 1921

About 62,400,000 short tons of stone were quarried in the United States in 1921, according to the U. S. Geological Survey. This is more than 20 per cent less than the production in 1920. The estimated value of this stone is $92,500,000, a decrease of 30 per cent as compared with 1920. Procedures all over the country stated that both wages and prices had been reduced, and nearly all reported a decrease in the cost of production. High freight rates are said to have contributed largely to the general depression in the industry.

Heavy Steelwork in New Theater and Office Building

Steel Trusses and Long Concrete Cantilevers Support Balcony Floor—Steel Girders Carry Columns and Suspended Floor—High Pitch Roof Truss Over the Theater

TO PROVIDE large spaces unobstructed by columns in the first story of the 21-story Keith office building and theater at Cleveland, O., which floor is occupied mainly by the entrance hall and ticket lobby of the theater in the rear, heavy steel girder construction had to be introduced to support the superstructure columns over these spaces and also to carry the front wall across a broad doorway. No truss work is employed in the office building, but the theater has a long steel truss carrying the front of the balcony over the main floor. This truss, with two shorter side trusses, forms the seat for concrete cantilever girders which support the balcony floor. In the structural layout many difficult points were encountered in order to adapt the framing to special features of the architectural design. The general arrangement of the office building and theater are shown in Figs. 1 and 2.

Floor Girders—Lines of single and double plate girders carrying upper columns and walls over the open spaces on the lower floors are the main features of the office portion of the building. Otherwise the framing consists mainly of I-beams. Columns are of I-section, composed of a web plate and four angles, with two or more cover plates.

In the front or Euclid Ave. section are four double plate girders of 33 ft. span, at the third floor level (see Fig. 1). These girders extend across the lobby and main entrance, and each girder carries one intermediate line of columns for the upper stories. They

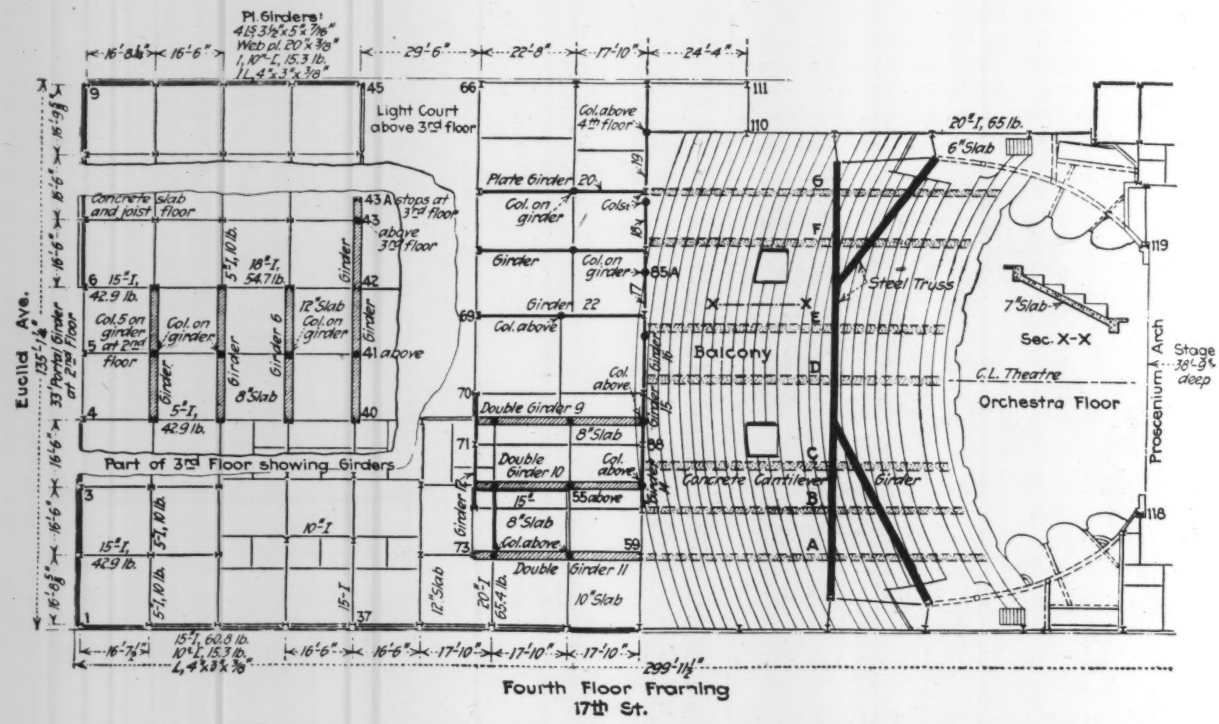


FIG. 1. FRAMING PLAN OF FOURTH AND THIRD FLOORS SHOWS TRUSSES AND GIRDERS IN THEATER AND OFFICE BUILDING

The site, at Euclid Ave. and 17th St., is 300 x 135 ft. On the corner is the office building, L-shaped in plan, with fronts 135 ft. and 138 ft. long and a depth of 68 ft. Behind this building, partly under the 17th St. or 138-ft. wing and partly in the space formed by the L, are the grand hall or foyer, the lobby, promenade, balcony foyer and other adjuncts of the theater. Beyond this intermediate part of the structure is the theater proper 162 x 135 ft., with the 40-ft. stage and fly gallery occupying the rear. Foundation conditions are simple. Groups of concrete piles driven in sand carry the pedestals or footings for the steel columns.

Three double girders of 40½-ft. span in the fourth floor framing of the wing are required to carry the upper office floors over the grand hall and other large spaces for theater purposes (see Fig. 1). These girders, like those of the third floor, are not built up as box girders, but each consists of a pair of 60-in. single-web girders placed close together. Upon shoe plates riveted across the top flanges of each double girder are seated two intermediate columns. The construction of the fourth floor girders is shown in Fig. 4.

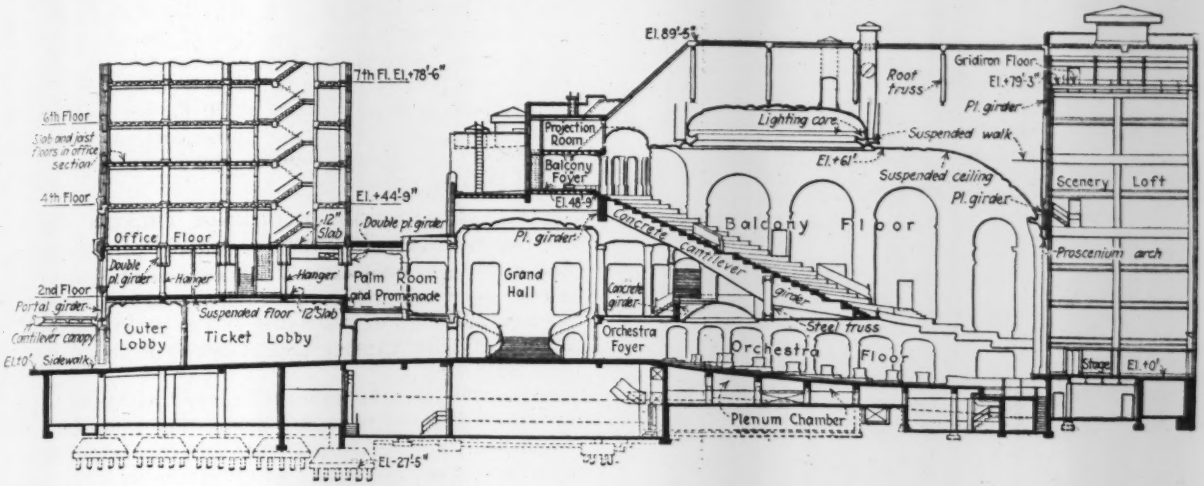


FIG. 2. SECTIONAL ELEVATION THROUGH OFFICES AND THEATER

The first of these girders (No. 11) has its webs framed on the flanges of two columns (59 and 73). In the others the arrangement is different, as shown in Fig. 1. At the inner end, the 60-in. double girder (No. 10) is seated upon an 80-in. girder 15 ft. 8 in. long (No. 12). At the outer end, the double girder is framed against the web of a 108-in. girder 15 ft. 8 in. long (No. 14). Two columns rest upon the double girder and a third, in line with them, is seated on the outer or wall girder, No. 14. These wall girders carry the intermediate columns over the entrances to the balcony.

For the relatively low structure in the space between the office building and the theater, single-web plate girders take the place of the double girders noted above. Each of these is framed between columns and carries a single column for the upper part of this intermediate structure (see Fig. 1).

Portal Girder—To permit of a wide entrance, a single-web portal girder of 33-ft. span and 7-ft. depth is placed at the second floor level in the Euclid Ave. front (see Figs. 1 and 2). This girder carries an intermediate column and the weight of the front wall. From the drawing, Fig. 3, it will be seen that each chord has four flange angles, forming a double channel section. A shelf angle on the outside supports architectural or decorative work. Angle brackets on the inside of the web carry an intermediate floor beam, the floor level being below the top chord of the girder. Hangers attached to the bottom chord support portal framing beneath the girder.

Wind Bracing—Substantial wind bracing is necessary in the office building owing to the height, narrowness and exposure. In most cases this bracing consists of large gusset plates above and below the spandrel

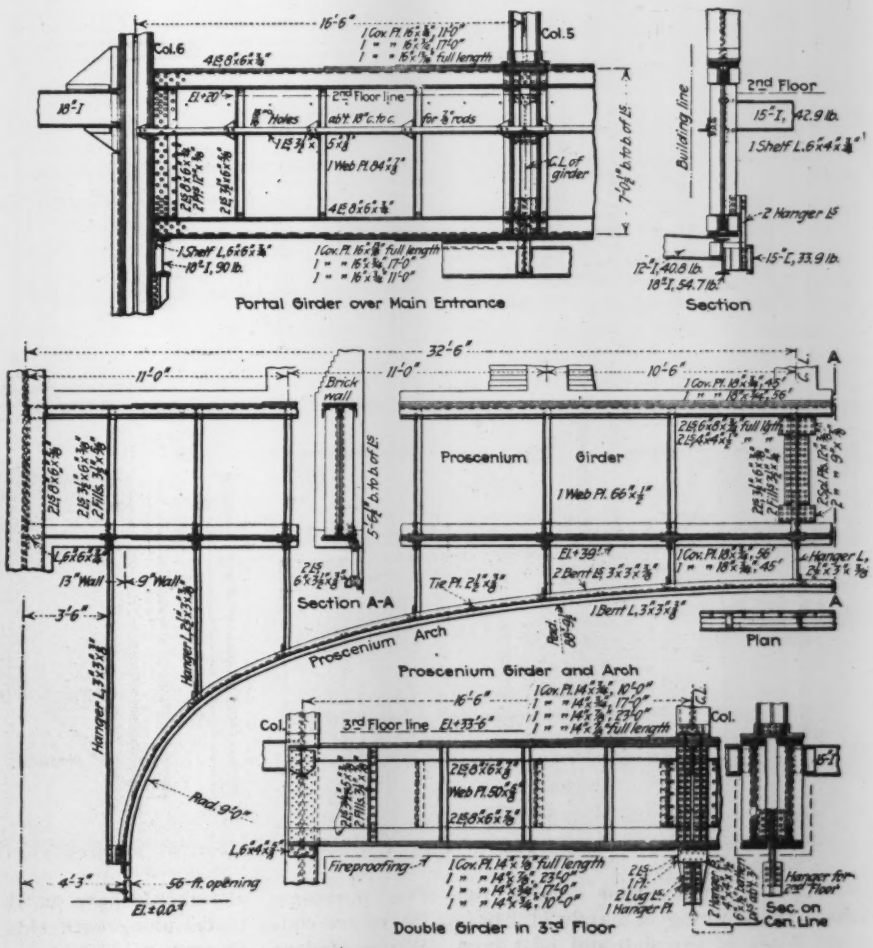


FIG. 3. GIRDERS IN THEATER AND THIRD FLOOR

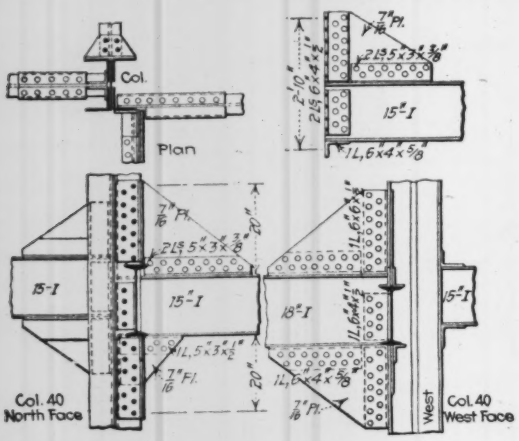


FIG. 5. WIND BRACING IN OFFICE BUILDING

beams, with angle connections to the flanges of beams and columns, as shown in Fig. 5. At some points these gussets are placed only above or below the beams, to conform to particular conditions and architectural requirements and to avoid all interference with openings.

are used in the lower stories, flat slabs 8 to 12-in. thick are used, according to the size of panel. The 12-in. slabs were required by the underwriters to separate the theater portion of the building from the office building. Floor loads are taken at 70 lb. per sq.ft. in the office floors, and 100 lb. for these portions which are subject to the heavy loading and movements of the usual theater crowds.

Structural Features of Theater

Steel trusses and concrete cantilever girders for the balcony, high pitched roof trusses and a long plate girder over the proscenium arch are prominent in the structural design of the theater. The general structural layout of both theater and offices is shown by Figs. 1, 2 and 6.

Steel Trusses—In order to carry the large balcony or upper floor without any supporting columns in the main floor, a steel riveted truss 106 ft. 3 in. c. to c. of bearings spans the entire width of the floor. Its ends are framed between interior columns at the line of the private boxes. It was necessary to make this truss very shallow in proportion to its span, so as to fit it between the ceiling over the main floor and the sloping floor of the balcony. With a depth of only 9 ft. 10 in. c. to c. of chords, therefore, its members are of very heavy construction, as will be seen by Fig. 7. Thus

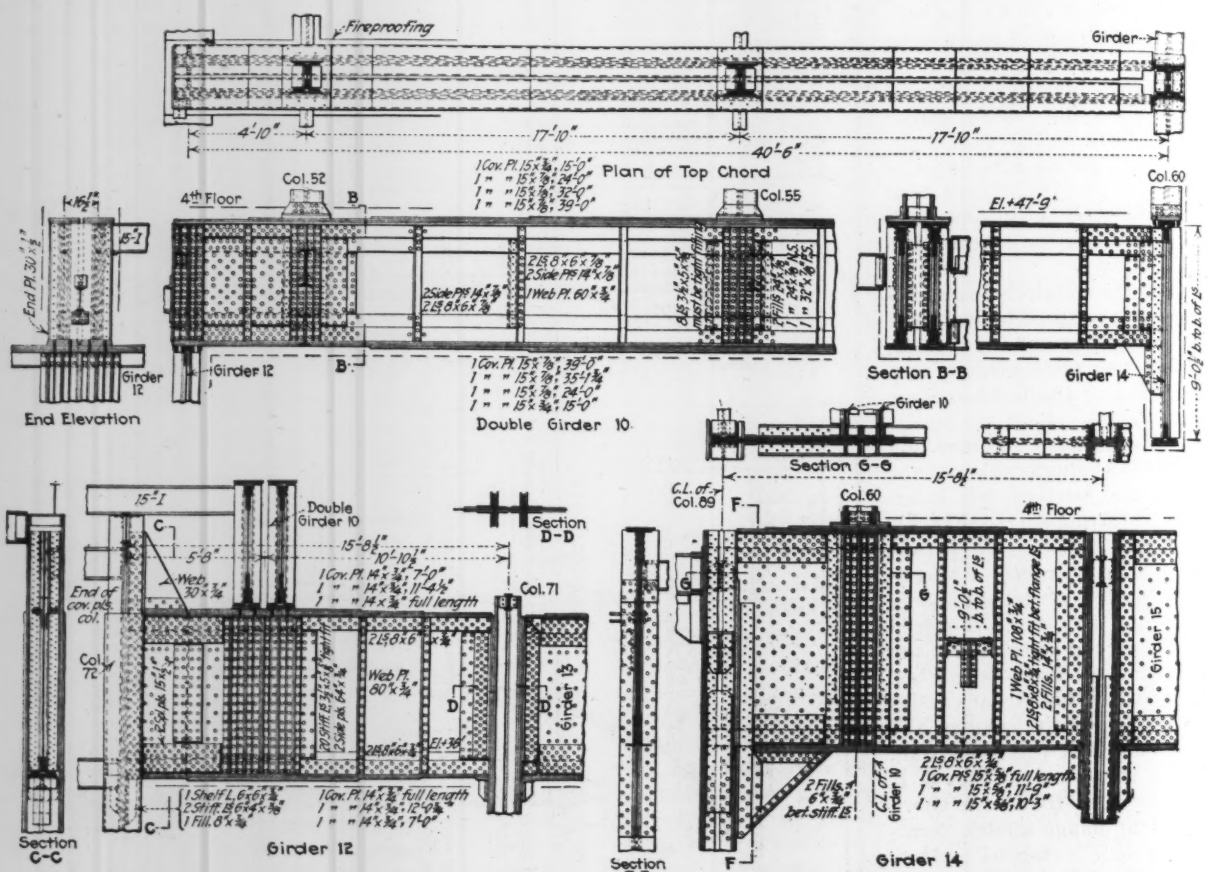


FIG. 4. HEAVY GIRDER FRAMING OF FOURTH FLOOR

Floors—In the upper stories for office purposes, where the framing is mainly of I-beams, there are concrete floors of the slab and joist type. Where girders the chords have an H section with four vertical cover plates along each side flange. With this arrangement it was possible to secure the necessary amount of

material more easily than would have been possible with chords of trough section.

Each of the main diagonals is of I-section, consisting of a horizontal web, four flange angles and two side cover plates. End connection plates were limited in size by the necessity of carrying corridors over the truss. Architectural conditions also prevented the connection plates to the columns being carried as far below the bottom chord as would ordinarily be considered advisable. The ends are reinforced, therefore, by plates extending as high as the floor elevation will permit.

Transportation and erection difficulties were increased by the requirement that each chord, with its connection plates, should be built up for its full length at the shops, no field splices being permitted. The 106-ft. bottom chord weighed about 45 tons and the 80-ft. top chord about 39 tons. These long members were shipped on flat cars and were hauled from the railway station to the site by teams of horses, each end of the girder being carried on a four-wheel truck. Before shipment, each truss was assembled complete at the shops as required.

To support the curved ends of the balcony, which project beyond the line of the main truss, two diagonal trusses are introduced, having their inner ends riveted to the main truss and their outer ends carried by columns of the interior framing (see Fig. 1). These diagonal trusses, one of which is shown in Fig. 8, are of similar design to the main truss, with each chord built up and handled as one piece. One truss is 49 ft. 8 in. long and 67 ft. 7 in. deep, and the other is 39 ft. 5 in. long and 5 ft. 6 in. deep.

End connection plates could not be allowed to extend below the bottom chord. For this reason, the supporting column is carried above the truss intersection to the floor line and a long rectangular plate is riveted to the column and truss, as shown. The 106-ft. main truss weighs about 116 tons complete and the two diagonal trusses weigh 18 and 14 tons respectively. All steel is cased with concrete 3 in. thick for the chords and 2 in. for the web members.

Concrete Cantilever Girders—To support the inclined floor of the balcony there are long concrete girders having their upper ends anchored to the steel framing

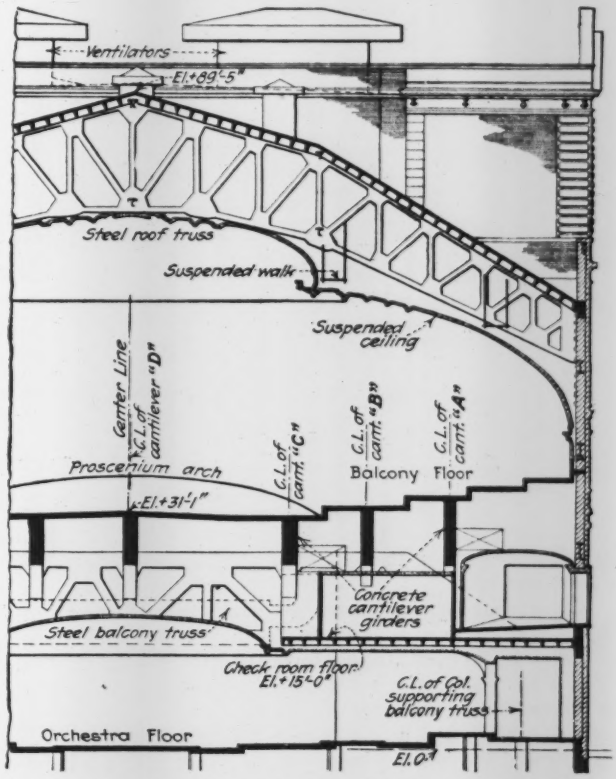


FIG. 6. PART CROSS-SECTION THROUGH THEATER

in the wall and their lower ends seated in the transverse steel truss, as shown in Figs. 1 and 2. Beyond this truss the girders have a cantilever projection of 27 to 30 ft. In order to provide seats for these girders in the trusses, the posts are composed of two vertical members about 2 ft. apart.

Concrete was used for these girders as it reduced the cost and avoided complicated connections to the truss which would have been necessary with steel girders. Owing to the curved plan of the balcony front, the end girders would have had an excessive cantilever length. To meet this condition, two diagonal steel trusses were

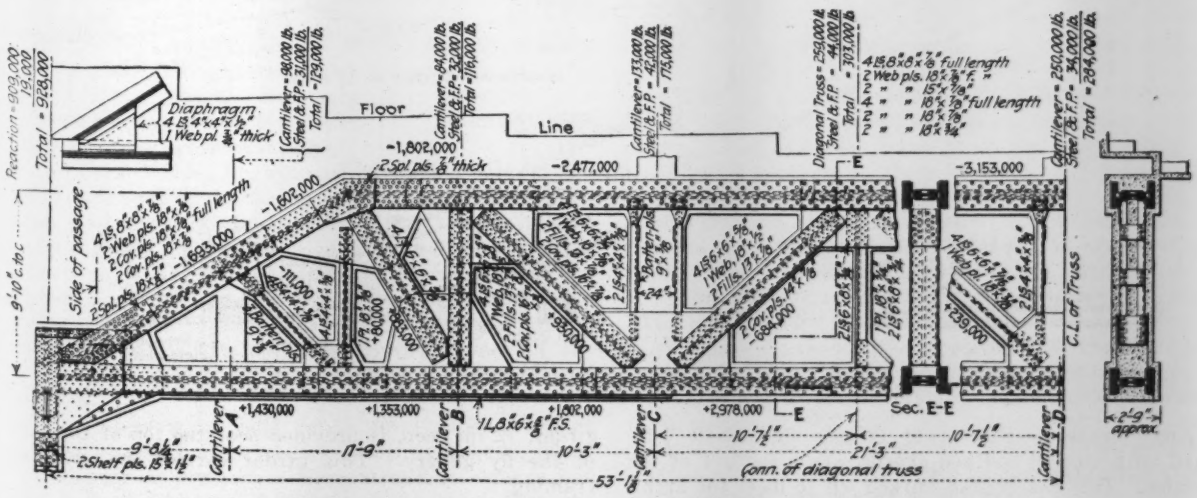


FIG. 7. LONG STEEL TRUSS CARRYING FRONT OF BALCONY OF CLEVELAND, O., THEATER

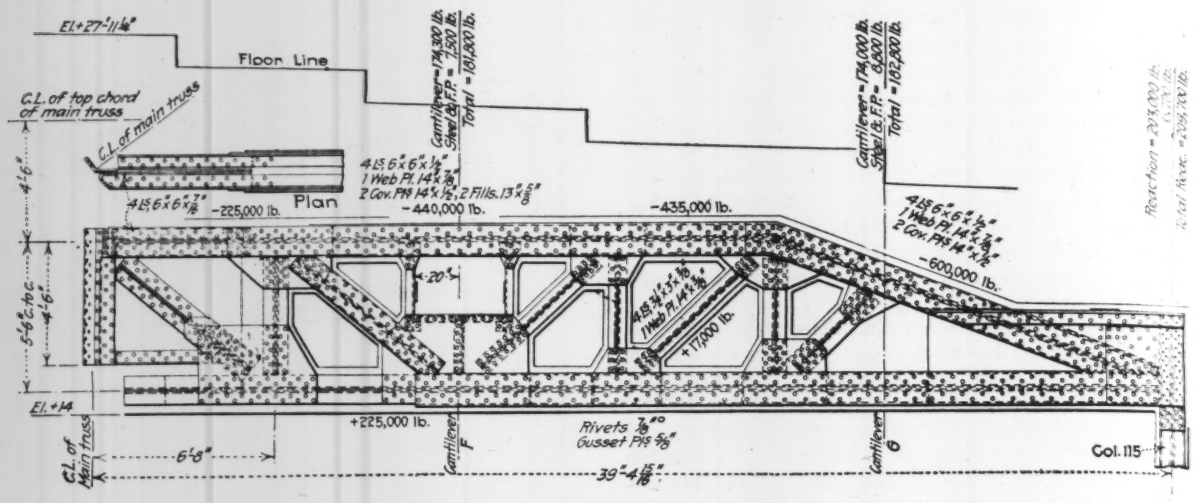


FIG. 8. DIAGONAL TRUSS OF BALCONY

provided to extend the seats for the longer girders, as noted above.

These concrete cantilever girders, Fig. 9, are from 4 ft. to 9 ft. deep and 18 to 24 in. wide. The upper surface is stepped to conform to the shape of the 3-in. floor slab, which was built monolithic with the girders. The risers of the steps, forming the joists, are of varying thickness, with a minimum of 5 in.

To meet the arrangement of stairways and passages giving access to the balcony floor at different levels, some of the corridors are reinforced concrete slabs suspended from the cantilever girders by steel hangers embedded in the concrete. At one point, however, such hangers would have been obstructive, and it was necessary to carry one side of the slab by a concrete girder of 55-ft. span. These arrangements are shown in Fig. 9, below.

The position of the trusses is shown in Fig 6 and the truss design is shown in Fig. 10. An unusual T-section is used for the top chord, composed of two 15-in. channels riveted back to back and a similar channel, with legs downward, riveted upon the top flange. The rise of the bottom chord is 20 ft. These trusses are spaced 18 ft. apart and are connected by sway bracing.

Proscenium Arch—Across the opening for the stage, the wall of the fly gallery or scenery loft is carried by a 66-in. plate girder of 65 ft. span (see Fig. 2), from which is suspended a curved angle member which outlines the proscenium arch. This arch rib gives an opening of 56 ft. and supports a brick spandrel, 9 in. and 13 in. thick. From the details of this girder in Fig. 3 it will be seen that the top chord has four flange angles, but their arrangement is different from that of the portal girder, also shown in Fig. 3. Another 65-ft.

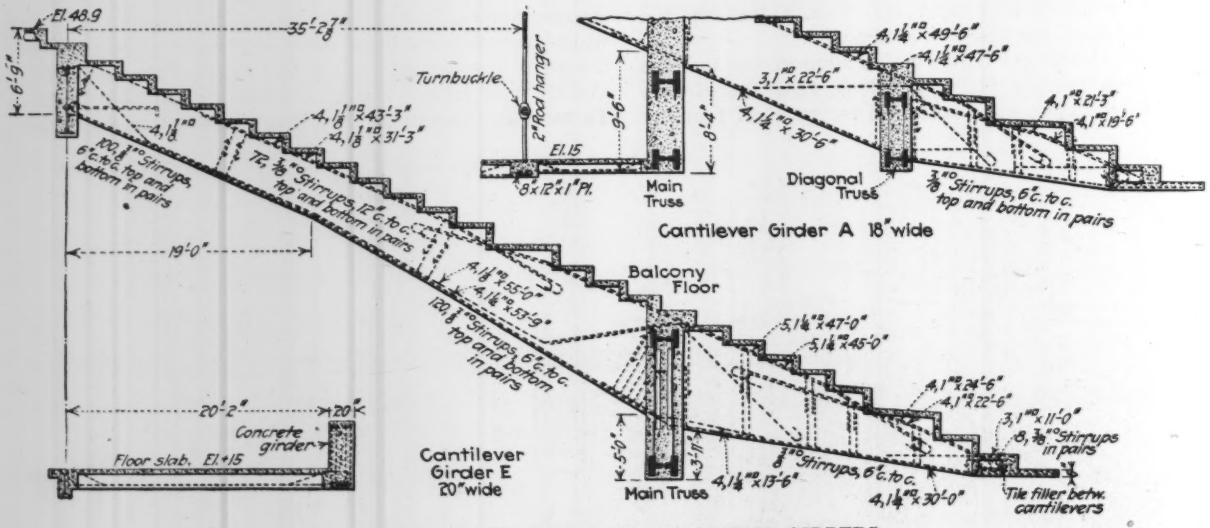


FIG. 9. INCLINED CONCRETE CANTILEVER GIRDERS

Roof Trusses—Steel roof trusses of 120-ft. 6-in. span with steeply inclined chords, are a feature of the theater. This design was worked out to meet the architectural requirements of low side walls and a lofty roof. girder, 72 in. deep, is provided near the top of the wall of the fly gallery. This girder carries the gridiron framing.

The architects for this building are C. W. and Geo. L.

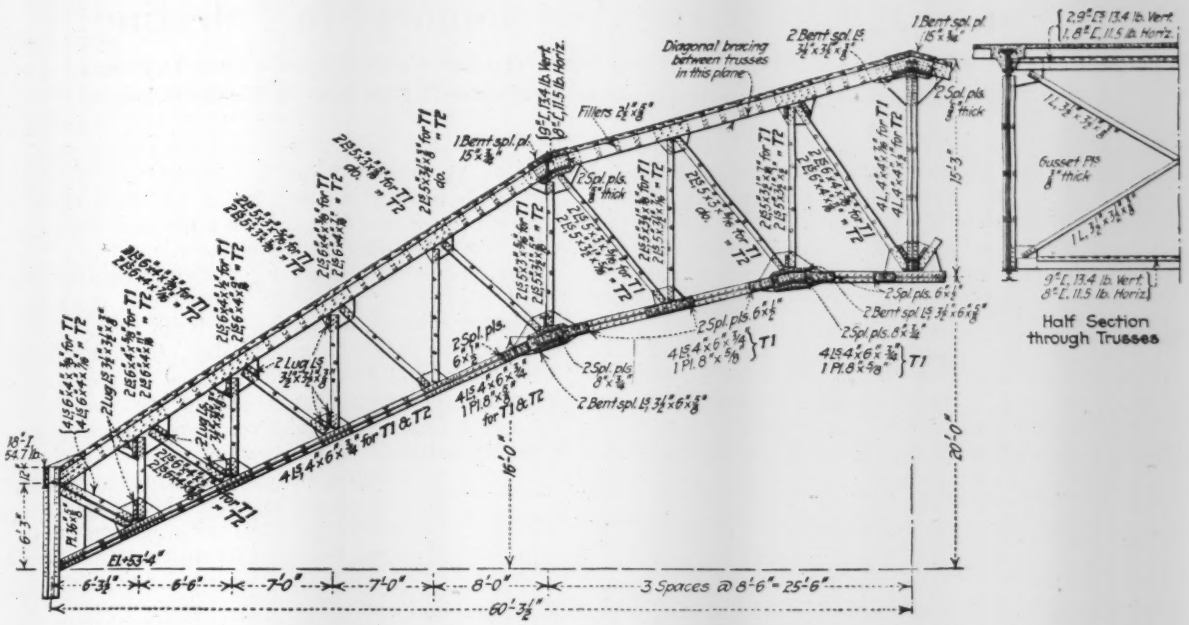


FIG. 10. HIGH PITCHED ROOF TRUSS OVER THEATER

Rapp, and the structural design was prepared by Lieberman & Hein, structural engineers, both of Chicago. The Lundoff-Bicknell Co. had the general contract, and the steel erection was done by the Bass Construction Co., both these being Cleveland firms.

Great City Planning Project on Pacific Coast Near Los Angeles

By Charles H. Cheney
City Planner, San Francisco, Cal.

THE largest single piece of city planning by private enterprise ever undertaken in this country for permanent development will be the new Palos Verdes Project in Los Angeles now being financed through nation-wide underwriting. We have the great examples of Washington, D. C., and possibly one or two other cities well planned in advance and built by public enterprise, and our great expositions have furnished stirring object lessons in what can be done by working to a carefully thought-out pre-arranged plan, for temporary dream cities. Now what city planners have long been urging for permanent city building seems likely of early accomplishment.

The Palos Verdes Project contemplates a new suburb which, although much larger, will be similar to Roland Park, Baltimore, Forest Hills, L. I., St. Francis Woods, San Francisco, etc., except that there will be a greater proportion of low-priced homes and home-sites. A marvelous piece of ground has been secured, containing 16,000 acres (25 square miles) and including almost 14 miles of ocean shore, at the southwest corner of the Los Angeles Metropolitan area, with Catalina Island opposite.

The underwriting calls for a total expenditure of $35,000,000, work to proceed as soon as $15,000,000 of this amount is available. Several million dollars has already been subscribed and it is expected that the $15,000,000 mark will be passed soon. Preliminary estimates of improvements include the following items:

Home building fund	$5,000,000
Streets and roads (125 miles concrete-paved)	6,000,000
Sewers	1,800,000
Water system	1,650,000
Cost of land	5,000,000
Oornamental plantings, art jury endowment	1,300,000
Hotels and clubs	2,000,000
Parks, schools and playgrounds	2,000,000
Three civic centers with business blocks	3,000,000
University	1,000,000
Transportation	4,000,000
Unapplied, taxes, etc	2,250,000
Total	$35,000,000

The $5,000,000 home building fund is expected to finance the building of several thousand houses, arrangement for second mortgage loans being provided in the trust agreement and title already being held to the land. It is proposed to use part of this sum for the organization of co-partnership housing, similar to that in England, in order to furnish working men's homes in quantity on easy terms, and with maintenance and upkeep provided. No buildings can be built anywhere on the property unless the plans are approved by the art jury, which will be a permanent body, endowed with sufficient funds to do real work. Restrictions will be similar to those in force in Roland Park, Baltimore.

The staff appointed to develop the project includes Olmsted Brothers, Brookline, Mass., and the writer; H. T. Cory, consulting engineer, San Francisco, chief of engineering; Hunter Liggett, supply service; Myron Hunt, chairman art jury, and others.

All funds are held and administered by the Title Insurance & Trust Co. of Los Angeles, as trustees.

Preliminary to the adoption of any general city plan a committee of the staff will this summer visit and check up on the principal city planning and housing schemes of the country in order to take advantage of as much previous experience as possible.

Power and Irrigation Development in Palestine

Complete Water Utilization for Agricultural and Industrial Service Projected—Long Dry Seasons Make Irrigation Necessary—Half a Million Horsepower Available—Large Part of Works Below Sea Level

AT JAFFA, on the Palestine shore of the Mediterranean, an electric power station with initial capacity of 1,000 kw. is under construction. Diesel engines will generate power from fuel oil. By the end of the present year the station will be completed and will be supplying electric current for the first needs of municipal and private service. Two other Diesel engine stations, at Haifa and at Jerusalem, are also to be built shortly and will feed into a transmission network to which the Jaffa station will be connected. At first these three stations will operate independently, but ultimately they will be merely reserve or peak-load elements of a large hydro-electric system centering in the valley of the River Jordan. These are the first units in the execution of a huge enterprise for which the Palestine government has granted concessions, embracing the utilization of substantially the entire water resources of the country. The main use is irrigation, by means of which great areas of irrigable lands may be brought up to a high level of production. The large heads available in the steep valleys will be utilized for power generation.

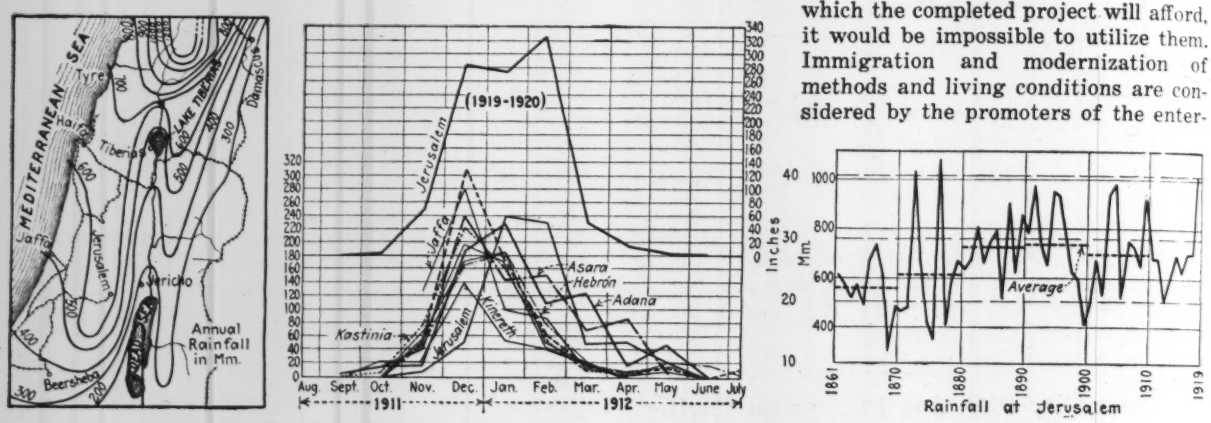


FIG. 1. RAINFALL DISTRIBUTION, MONTHLY AND ANNUAL VARIATIONS IN PALESTINE
Total annual precipitation fairly high, but dry summers make irrigation necessary for adequate development of agriculture.

Work on the first stage of the hydraulic power development is scheduled to begin in March, 1923. This involves the construction of a power plant on the Jordan about eight miles below its efflux from Lake Tiberias, construction of a supply canal from the lake, regulation of the lake level by a controlling dam at its outlet, and erection of a transmission line from the power station to Haifa and thence to Jaffa and Jerusalem, at a total cost of about $5,000,000. The ultimate development will require about twenty times this expenditure.

Two years of study have been devoted to the preliminaries of this project by Pinhas Rutenberg, civil engineer. His recommendations have been accepted by the Zionist interests and Baron Edmond de Rothschild as an essential foundation for the upbuilding of the country. The enterprise is of vast extent, covering practically the whole length of Palestine from north to south and the major portion of its width, from the Mediterranean to the eastern border of the Jordan valley. Not only its size, but also the conditions in the country at present make it impracticable to execute the whole project at once, but it will have to be constructed in successive stages, in a measure keeping pace with the upbuilding of the country.

The primitive character of living conditions, the small population, the crude agricultural methods employed, the waste character of large portions of the country, the lack of skilled labor, the inefficiency of local labor, and the virtual absence of any extensive industrial development are among the factors which determine this necessity. Even were it possible to provide immediately the superior productive facilities which the completed project will afford, it would be impossible to utilize them. Immigration and modernization of methods and living conditions are considered by the promoters of the enterprise to be prime essentials of the successful realization of the ultimate project. Already there is distinct evidence of the assimilation of modern methods of agriculture and construction. One striking example was furnished about a year ago, when American organizations interested in Palestine sent to the Jewish co-operative labor organizations there a gift of modern machinery and tools, such as plows, tractors, seeding machines, excavators, concrete mixers, road rollers and the like, to the amount of more than $100,000. This machinery was at once put to work in different parts of the country, with great success. Further, some of the recently founded agricultural colonies, among them Rishon-le-Zion, Petach-Tikvah, Rechoboth and Migdal have developed most successfully, and in their general aspects and prosperity give proof of the economic results of modern methods of work.

Recently, Mr. Rutenberg reports, he tried out Jewish labor under the most difficult conditions, in a part of the Jordan valley where malaria was prevalent, and secured most satisfactory results, both as regards efficiency and as regards the endurance of the workers. The benefits to be derived from the introduction of machinery should also reach the Arabs, who are expected to develop into good laborers.

A 70-year concession to the interests planning this development has been arranged by the Palestine government for the development of the country's complete

water resources. With the general powers have been coupled broad auxiliary powers, including the construction of electric railways, housing and manufacturing establishments. Rates and other conditions of operation of public-service elements of the development are to be under government regulation. The growth of the country will call for extensive housing construction, and material for this as well as other construction and production is largely lacking. Thus the erection of a cement mill, brick works and the like will be early requirements, and for this as well as transportation development the auxiliary powers are essential. The government is extending the project every encouragement because its successful execution will increase the general prosperity of the country. The recent decision

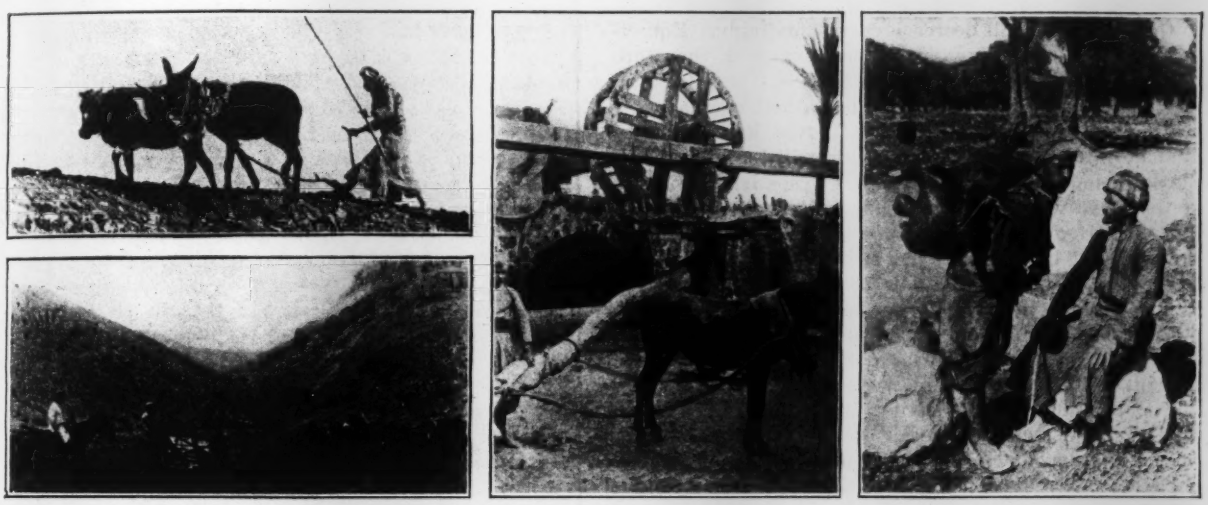


FIG. 2. PRIMITIVE METHODS PREVAIL IN AGRICULTURE AND WATER DISTRIBUTION
Old Wooden Plow and Modern Reaper—Irrigation wheel for garden—Domestic water supply by carrier.

of the government to electrify the Jerusalem Railway, as the first step in the electrification of all the Palestine lines, will have a close relation to the execution of the present enterprise, as power for the operation of the railway will be supplied by the transmission network.

Situation and Hydrology—Palestine is essentially a mountain and plateau country (see topographic sketch map Fig. 3). It represents an area of about 120 by 270 km., which at present has a population of only 700,000. The climate is semi-tropical and semi-arid. The country long ago was deforested, and the fertile soil has been washed away from the high ground. The valleys are fertile, but neglect has allowed them to become marshy and malarial. Sanitation by drainage will be an important item of engineering work in the development of the country.

There are highly fertile valleys around Jaffa, where, for example, orange growing is already so fully developed that a million cases of oranges per year are now exported to Europe. The region around Haifa promises great industrial development.

The highest ground is in the northern part of the country, where elevations of 7,000 to 9,000 ft. are reached in the Lebanon and Hermon mountains. Thence southward the larger part of the territory drains by way of the Jordan River to the Dead Sea, a sink 400 m. below sea level and of 355 sq.mi. surface area, whose evaporation consumes the inflow. The Jordan extends southward from the slopes of the Lebanon and Hermon ranges at a distance of about 40 miles from the coast, dropping in elevation through Lake Merom which is nearly at sea level, thence through Lake Tiberias, which lies 200 m. below sea level, to the Dead Sea.

Precipitation has been recorded by a number of scattered series of observations, at schools, monasteries and the like, in a few instances for as much as sixty years past. From the figures an average of 630 mm., or 25 in. annual, has been taken as the mean supply of Palestine. Evaporation from water surfaces is high, ranging in the southerly portion, for example, from about 40 in. at Jerusalem to about 150 in. at the Dead Sea. Rainfall contours are given in the left-hand drawing of Fig. 1, based on averages compiled from the various records. The other two diagrams of this figure show the monthly rainfall distribution and a long-time record of annual precipitation for Jerusalem.

Reference to the rainfall map will show that substantially the whole southern half of the country is somewhat deficient in rainfall, although a belt of rather high rainfall extends southward along the mountain and plateau region. The annual precipitation total is large enough to assure a sufficient stream flow, but the critical feature of the climate is the fact that practically all the rain falls in six months, from November to April inclusive, while May to October are dry months. Factors of run-off are the absence of forests, the steep slopes of the valley sides, and the intense rains during the winter months. The unfavorable distribution of rainfall creates the necessity for equalizing the supply of water by storage and irrigation.

Storage—In order to make the winter rainfall available for summer use, water must be stored. A large total of storage will be required, even without any carrying over of water from year to year. On the map Fig. 5 are indicated the locations of nine proposed storage reservoirs, with an aggregate utilizable capacity of about 600,000,000 cu.m., or 500,000 acre-ft., two-

fifths of which is in the upper Jordan valley, while the remainder is in the eastern tributary valleys.

While these quantities are large in themselves, they are hardly more than moderate in consideration of the large area of territory to be served. In this connection, however, the large storage or equalization effect of Lakes Merom and Tiberias must be taken account of. Controlling dams giving about 7-8 m. range of level in these lakes will develop utilizable storage of 100,000,000 and 1,000,000,000 cu.m., or 80,000 and 800,000 acre-ft. respectively, which exceeds the storage in the artificial reservoirs.

Relation to Dead Sea—All the drainage from the central part of Palestine is carried to the Dead Sea. When a large proportion of the river flow is distributed over the land for irrigation use and the evaporation from the land surface is thereby increased, the inflow to the Dead Sea will decrease correspondingly. Equalization of lake inflow and evaporation will therefore result in a smaller water area, that is, the lake level will be lowered. At present a large belt of the outer portion of the lake, possibly well over half its area, is shallow (2-3 m. depth) and this will be laid dry by the lowering of the lake resulting from irrigation use of the river water. As the lake water contains 33 per cent dissolved solids, the expectation is that the land exposed will be found to be rich in mineral deposits.

At present the Jordan flow at Lake Tiberias ranges from about 12 to 65 cu.m. per second. With complete storage and regulation, and some use of water above Lake Tiberias, the lower course of the Jordan will have a regulated flow of 33 cu.m. per second.

The Jarmuk River, flowing into the Jordan below Lake Tiberias, carries rather more than 20 cu.m. per second average flow. Its prime importance in the general scheme is due to the fact that its waters can be stored at a high elevation and therefore are best used for irrigation, since they can be brought to land lying at an elevation of as much as 250 to 300 m. above the level of Lake Tiberias, while even higher areas can be reached by pumping.

Accordingly, it has been deduced that the most favorable division of use of the waters in the lower Jordan valley will be realized if the Jordan outflow from Lake Tiberias is utilized for power—the larger part of the 186-m. drop between Lake Tiberias and the Dead Sea can be developed—while substantially the whole of the Jarmuk is taken for high-level irrigation supply for the Jordan valley, with siphons crossing the valley and conveying irrigation water from the east to the west slope of the valley.

Spring and Marsh Conditions in Upper Jordan—A fall of about 200 m. is available in the short stretch between Lake Merom and Tiberias, offering an inviting opportunity for power development. However, the present lack of means of communication and the more urgent necessity for reclamation and irrigation storage development above led to the conclusion that this intermediate stretch is not to be preferred as earliest power development site.

Some miles above the head of Lake Merom is a region of foot-hill springs, constituting the principal source of the Jordan. There are three main springs (the spring of Dan is illustrated in the view Fig. 6), and it is important that their outflow be conserved by developing a storage reservoir at each of them. The project provides for five such reservoirs accordingly, as indicated on the map Fig. 4. By their aid it will be possible to provide irrigation for the broad plains lying directly north of Lake Merom, after their reclamation. Lake Merom itself will also be used as an equalizing storage reservoir, and its outflow will be utilized for power development in the nearly 200-m. fall to Lake Tiberias.

Reclamation of the Hulle marshes, above Lake Merom, is the first necessity in connection with this

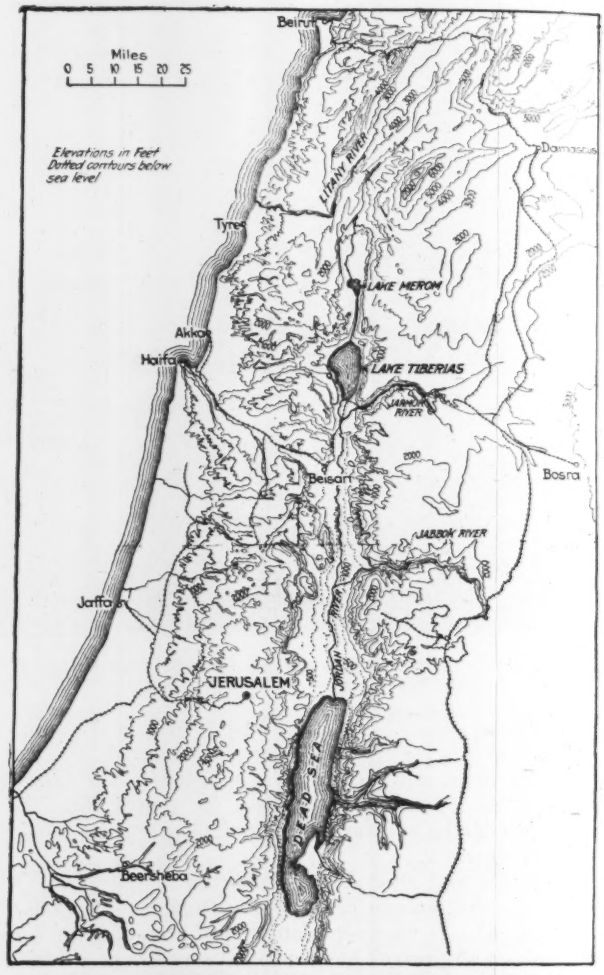


FIG. 3. MOUNTAINOUS TOPOGRAPHY CONTROLS PALESTINE WATER RESOURCES

headwater development. These marshes form a highly malarial region, and their drainage is important for headwater development. These marshes form a very fertile ground, which when drained and properly supplied with water by irrigation will increase the agricultural productivity of this part of the country very greatly. The governing condition in the maintenance of the marshes is a series of three rock dikes in the bed of the Jordan below Lake Merom, and the first step in drainage will be the enlargement of the river channel by cutting through these dikes.

Power Supply to Coast—Sufficient power-development capacity exists along Jordan and its tributaries to supply a large industrial population. The coast

cities will be the heaviest users, besides the railways. The cost of coal, now about $20 per ton, makes steam power of prohibitive cost; hence the great importance of hydro-electric supply to the coast.

A transmission network as outlined in the map Fig. 4 is to extend from Haifa in the north to Beersheba in the south. Hydraulic power stations would be located at the points indicated, providing an ultimate total of about half a million horsepower, which can be utilized advantageously in railway operation and industrial and agricultural use.

Canal System.—By the proposed storage of water of the upper Jordan, and its augmentation by a supply of 30 cu.m. per second from the Litany drainage area, three main utilization canals will be fed:

1. On the east side of the Jordan, the Trans-Jordan Canal, lying about 150 m. above the level of Lake Tiberias. This canal is wholly supplied from the Jarmuk in its upper section, but farther down receives additional flow from the Jabbok. The total amount of flow in the upper section will exceed 40 cu.m. per second maximum (20 cu.m. per second yearly average), while at the lower end this amount will be increased by 10 cu.m. per second yearly average from the Jabbok. A part of this water will be conducted by siphons to a parallel irrigation canal on the western slope of the valley, approximately on the same level as the main Trans-Jordan Canal.

2. West of the Jordan, the Cis-Jordan Canal (El.-208) supplied from Lake Tiberias. Its maximum flow will be something more than 70 cu.m. per second, i.e., twice its yearly average.

3. North and west of Lake Merom, the Western Hulle canal for the irrigation of the valleys of Esdrelon, Asoxi and Acre. Its flow, 30 cu.m. per second (60 in the irrigation season), will correspond to the Litany supply diverted to the upper Jordan. The Hulle marsh region will be irrigated directly by its own canal system from the Jordan water. There is also planned an irrigation supply to the valleys near Tyre and Sidon, from the lower reaches of the Litany.

As previously indicated, the relative elevations of the sources lead to devoting the Trans-Jordan Canal wholly to irrigation use in summer (power in winter), while the Cis-Jordan Canal is largely given to power development. It is calculated that the system as described will suffice for irrigating a total agricultural area of 282,000 hectares (650,000 acres), distributed as follows:

Hulle	22,000	hectares
Eastern slope of Jordan	82,000	"
Western slope of Jordan	48,000	"
Esdrelon, Asoxi, and Acre	90,000	"
Tyre and Sidon region	40,000	"

There is a possibility that the development of better reservoir sites in the Jarmuk valley, when more complete surveys can be made, will enable the level of the Trans-Jordan Canal to be raised by another 50 m. or more. This would permit direct irrigation of a larger area without pumping.

Jisr-el-Mujamieh Plant—The first unit of the enterprise to be built is the power plant on the Jordan just below Lake Tiberias. Detailed surveys have located it at Jisr-el-Mujamieh, about eight miles below the foot of the lake. At this point a flow of 50 cu.m. of water is available, with 40-m. fall from the lake, giving a 24-hr. capacity of 20,000 hp., or 40,000 for 12-hr. use. It is planned to develop at the start 12,000 kw., with 8,000 working and 4,000 reserve capacity.

A low regulating dam in the Jordan directly at the lake will constitute the intake and river-control works. A canal leading thence along the hillsides to the power plant, an equalizing reservoir, supply penstocks and generating station will constitute the development. Transmission lines will carry the power to Haifa, Jaffa

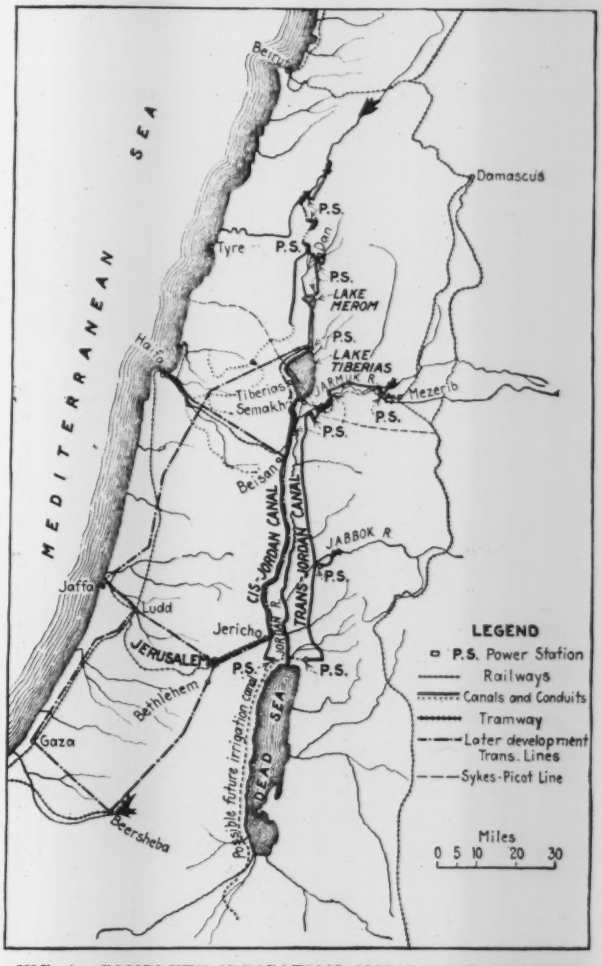


FIG. 4. COMPLETE IRRIGATION AND POWER PROJECT
Four rivers will ultimately be utilized for irrigation and power: the Litany, the Jordan, the Jarmuk and the Jabbok.

and Jerusalem; they will form a 66,000-volt system with branch service at 15,000 volts, 6,000 volt supply networks in the towns, and 110-220 volt distribution to consumers.

On account of the availability of natural storage (Lake Tiberias), elimination of high dam construction and the like, the cost of the development will be low. The cost of the Jisr-el-Mujamieh development to 12,000 kw. capacity is estimated at £1,000,000, subdivided as follows:

Canals, headworks and penstocks, £250,000; power house and machinery, £180,000; 200 km. transmission line, £150,000; low-tension and distribution networks (half of ultimate cost), £100,000; steam reserve stations, £100,000; contingencies, £200,000; land £20,000.

An immediate market for an energy output of 15,000,000 kw.-hr. is available in domestic and industrial service. The low development cost will permit of selling at so low a rate, it is said, as to make electric power available for heating and cooking, and in the coast cities there is considerable need for domestic heating. Once the electric supply is available, it is believed, a very rapid growth of demand will take place.

Construction on this unit will begin next spring, the necessary initial capital having been largely secured in Europe and the United States. The main participants in the enterprise up to the present are the Jewish

FIG. 5. UPPER END OF LAKE MEROM
View looking northeast, Hermon Mountains in distance. Reclamation of marshes just north of the lake is to be one of the early parts of the enterprise.

FIG. 6. SPRING OF DAN, ONE OF THE MAIN SOURCES OF THE JORDAN
Impounding reservoirs will conserve the flow of the springs at the foot of the mountains and the flow of the upper tributaries.

Colonial Trust, of London; Baron Edmond de Rothschild, of Paris; the Palestine Development Council, of New York (Justice Louis Brandeis, honorary chairman). The company will be formally organized within the next few months, preparatory work will be carried on during the coming fall and winter, and construction will begin in March.

So far as can now be told, the second step in the execution of the enterprise will be drainage of the Hulle marshes and impounding of the Jordan springs. This will carry with it immediate irrigation following upon agricultural reclamation of the marsh land, and housing and transportation development.

It should be added, as a minor element of the scheme, that domestic water supply will be provided for throughout the region covered by the hydraulic works. Municipal operations in general will form a large part of the working out of the project.

Why One Standard for Portland Cement?

From a paper by P. H. Bates, of the U. S. Bureau of Standards, presented to the Franklin Institute, and entitled "The Application of the Fundamental Knowledge of Portland Cement to its Manufacture and Use."

AT THE present time there is but one standard for portland cement, no matter into what use it ultimately goes. Is this good practice? The answer must be in the affirmative if considered from the viewpoint of our present knowledge of cement testing. The practical cement user, however, has answered the question negatively in many cases, when he uses one or more brands in preference to others for certain classes of work or at certain periods of the year. In this connection may be cited the belief that certain brands always produce a non-dusting floor, while other brands produce a dusting floor. In all cases the various brands invariably meet the requirements of the standard. The requirements of the latter do not bring out the differences which usage has found to exist. Hence for certain uses special tests will have to be devised which will determine the desirability of any brand over another for any particular case.

The question arises as to what is a particular case. Should cements for massive construction be different from those for road construction, or for interior pavement, or for sea water or alkali work, or for reinforced concrete? The former does not of necessity demand high tensile or compressive strength like the latter, while for the pavement strength is of relatively minor importance when compared with non-dusting. For sea water or alkali resisting work the physical properties are relatively of minor importance when compared with the need of resistance to chemical action.

High compressive strength can be secured by a high tricalcium silicate content, a silica content of about 20 per cent, a usual alumina content and hard burning of such a raw mixture ground more finely than is usual. Such a cement, however, is brittle, and of low tensile strength after an early age, hence it is not desirable for road work. It commends itself for floors but requires special skill in handling or it will dust continuously. Material changes in our present tests would have to be made to show the value of any marked changes in methods or procedure of manufacture. Earlier strength tests than 7 days would be required; both a tensile and compressive test would have to be considered and a test to determine the coefficient of expansion with age. If by change in composition it can be shown that a cement more resistive to salt action can be secured it may be necessary to incorporate further chemical determination in our specifications. The possibility of determining the quality of the cement in a concrete at a late age by an accelerated test, in other words determining its cementing qualities when it has largely hydrated, is worthy of much research. Hence aging at higher temperatures in an atmosphere of water vapor should be a subject of much further and more logical work than heretofore.

Enforcing Vehicle Law in California

The California Highway Commission, co-operating with the supervisors and traffic officers of the state, is making a determined effort to stamp out overloading. The commission has organized an inspection department under direction of Major C. L. J. Frohwitter, a retired army officer, who has five assistants, mostly ex-service men deputized by the motor vehicle department. These inspectors equipped with automobiles and loadometers for weighing trucks on the highways where found are working through the state where overloading is most flagrant. To date Major Frohwitter reports that 50 per cent of the trucks apprehended violated either the gross weight or tire provisions of the Motor Vehicle Act. The allowable gross weight in California is 30,000 pounds.

To Avoid Variable Concrete Due to Variable Sand Wetness

New Method of Mixing Proposes Inundating Sand Before Dumping in Mixer Thus Keeping Moisture Content Constant

By R. L. BERTIN

Chief Engineer, White Construction Co., Inc., New York City

VARIABLE moisture content of sand is responsible for a large part of the variation in the strength of field concrete. Not only does the changing amount of water, due generally to atmospheric conditions, affect the bulk of the sand and thereby the amount used in the mix but it makes it extremely difficult to gage the proper amount of water to add in order to get the optimum concrete.

In attacking this phase of the problem of proportioning concrete there has been evolved what is thought to be a practical method of measuring sand and water regardless of the moisture content. This method, which has been developed after a considerable amount of experimentation, should result in the elimination of such variables as are the direct cause for the lack of constancy in the absolute quantity of materials contained in successive batches of concrete. An extended series of tests is about to be made with the view of getting more definite information, but the present status of the development seems worth noting.

It is a well known fact that the volumetric measurement of sand with varying moisture content is no gage of the absolute amount of sand measured or the amount of water carried by this variable amount of measured sand. Measurements by weight while giving closer results lack constancy to the extent of the variation in moisture content. The problem which presented itself was to find some method of measuring sand containing any percentage of moisture in such a way as to insure a constant known amount of given sand and constant amount of water contained therein in successive measures, irrespective of the moisture content of the sand as measured.

Two methods of making the water content constant suggested themselves. One was to dry the sand, which is considered impracticable, and the second was to inundate it with water; in other words, fill the voids completely with water.

The next step, which was thought probable and later proved by a series of tests, was to determine whether a given sand in an inundated condition has a constant void factor. The basis of this belief was the fact that if surface tension were done away with in damp sand by inundation, the bulking effect would disappear and therefore a fairly uniform ratio be obtained between weight and volume. It was found experimentally that if sand be poured in a container partially filled with water, the amount of water therein contained being in excess of that required to fill the voids, until the sand and water level have reached the top of the container, a fairly constant weight of sand and water was contained therein, so long as the specific gravity and void factor of the sand remained constant or nearly so. The only two disturbing factors which it was thought might interfere with the accuracy of the measures, were first, the absorption of the sand, and second, the air entrapped within the voids of the sand. However, since only the constancy of measurement was sought, it was thought and verified that these factors would not vary much, and would not effect the constancy of results.

The coarse aggregate carries a certain amount of water, but it was found that by keeping the stone pile wetted that this amount of water was small and fairly uniform and that no compensation was necessary since there was but a slight variation.

Sand and Water Container—A container was then designed based on the above principles, a description of which follows:

The container is cylindrical in shape and divided in two vertical sections, the upper intended to contain the right amount of inundated sand required for a batch, and the lower section the complement of water required beyond that contained in the inundated sand and the wetted stone to supply the total amount required for the batch. The two bottoms are made adjustable so as to permit of changes in capacity in the event of variations in grading or voids of the aggregate, or proportions of mix requiring changes in the sand and water quantities. The intermediate bottom is provided with fine screens to permit the water to enter therein and exit therefrom.

In operating the container, it is first partly filled with water, the lower container being completely filled and the upper container to a point so that enough water is provided to more than fill the sand voids. Sand is then dropped into the water contained in the upper section until it is filled to the top with inundated sand, the excess water spilling over the top sides. The container is then emptied into the mixer hopper, thereby delivering to the mixer known amounts of sand and water which are constant from batch to batch.

A number of preliminary tests were conducted with the view of ascertaining the practicability of the method described above and the accuracy of results obtained. In making these tests a certain proportion was adopted and the sand was used in different condition as to moisture content, from perfectly dry to saturated. The materials which were used were of one kind for all tests.

Conclusions—The observations and conclusions derived from these tests are as follows: (1) The amounts of water and sand in successive batches are practically constant; (2) the plasticity of the concrete produced as determined by the slump tests shows only slight variations; (3) the cement factor in successive batches is nearly constant; (4) the amount of concrete in each batch measured by volume or weight is nearly constant; and (5), the strength of the concrete tested at 28 days is fairly uniform.

If the conclusions noted above are proved to be facts by the tests, the method promises a solution of the problem of specifying of concrete by strength which has been recently proposed.

Iowa Spent $39,000,000 on Roads in 1921

Iowa, during 1921, spent for road and bridge building on her 104,082 miles of public highway, $38,741,627.53. Primary road expenditures on 6,616 miles for road work only totaled $16,996,807. County road system expenditures on 10,681 miles totaled $5,766,484. Township road expenditures based on 1,359 townships totaled $6,672,985. Bridge expenditures on the three systems, primary, county and township, totaled $9,305,352.

Large Steel Highway Bridge Destroyed by Abutment Washout

By G. G. Wickline
Bridge Engineer, State Highway Department, Austin, Tex.

THE fall of a 300-ft. steel span, one of two forming the Marlin-Belton bridge across the Brazos River, five miles west of Marlin, Tex., on May 16, threw into the river about a score of people who were standing on the span, and eight of them were drowned. The river was at flood stage. A washout in the west approach was being repaired by constructing timber cribbing and filling it with stone and earth. This work was to have been done within a few hours, when the abutment slid into the river from undermining, dropping the span it supported.

A new oil field is being developed on one side of the river, and traffic is rather heavy and insistent upon using the structure. Due to the importance of the road and the development of the oil-field traffic, the chamber of commerce of Marlin and the commissioners court of Falls County have made arrangements with the War Department to maintain and operate a pontoon bridge at this location until a new structure can be provided, which will probably require several months.

The bridge was built a number of years ago, before the organization of the state highway department. It was erected by a bridge company, which furnished its own plans and acted as its own engineer in the matter of passing on the foundations for the piers and abutments. In those days a certain sum of money usually was available to build a bridge to cover a certain distance, and bridges were built to suit the available sum without very much regard to the strength and stability of the structures. However, it should be said that the Brazos River from Waco to its mouth is a very treacherous stream, in which shifting of the channel and sliding of banks are frequent occurrences.

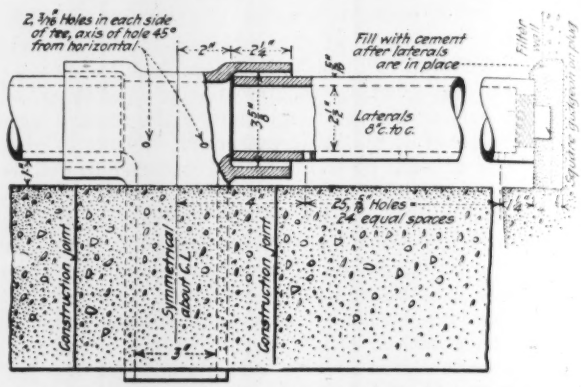
As the bridge is not located upon a designated state highway, it will probably be rebuilt by some bridge company with a span that is as likely as not to be a duplicate of the span which remains.

WRECKAGE OF THE BELTON BRIDGE OVER BRAZOS RIVER AND SITE OF WASHED-OUT WEST ABUTMENT

A score of people was on the span at the time it fell, and eight of these were drowned. The river was at a flood stage and a washed-out section of the west approach was being repaired with timber cribbing. The repairs were nearly completed when the abutment slid into the river as the result of undermining. The bridge was designed by the bridge company which built it, and this company acted as its own engineer in the matter of passing on the foundations for the piers and abutments.

Perforated Pipe Underdrains for Alpena Water Filters

UNDERDRAINS in the four filters of the new 3-m.g.d. municipal water purification plant for Alpena, Mich., are of the perforated-pipe type. There is no manifold but the 2½-in. cast-iron pipe laterals are leaded into tees, the long outlets of which extend through the floor to a rectangular concrete collecting conduit extending longitudinally under the center of the filter floor. The conduits are reinforced and form the tops of supporting columns. The accompanying drawing shows the detail of the setting, perforations and spacings.


2, 3/16 Holes in each side of tee, axis of hole 45° from horizontal
2"
2¼"
Fill with cement after laterals are in place
Laterals 6" c. to c.
25, ⅜" Holes - 24 equal spaces
Construction joint
Symmetrical about C.L.
Construction joint
3"

PERFORATED FILTER LATERALS FOR ALPENA

In setting the tees, which are grouted in some time after the concrete in the floor has been deposited, a plank with holes drilled ⅜ in. deep at the 8-in. spacing is braced against the bottom of the floor to fix the lower ends of the tees while grouting. The extension of the tees below the bottom of the floor serves no other purpose.

The 17-in. gravel underdrain depth is designed for a 24-in. vertical rise in the wash water. The bottom layer of gravel is of 2-in. size and as the bottom of the laterals is 1 in. from the floor a channel is left under the laterals. The top of the 28-in. sand layer is 26 in. below the crests of the wash-water gutters to care for the maximum rise of sand expected with the minimum size of sand. At the maximum rate of washing the velocity through the openings in the lateral is 12.15 ft. per second. The opening is 0.27 per cent of the filter area.

The plans and specifications were drawn and the construction is being supervised by William G. Clark, consulting engineer, Toledo, Ohio.

Illinois Municipal Review

The Illinois Municipal League has begun the publication of a journal called the *Illinois Municipal Review*, which is to be issued six times a year.

Comparison of Mechanical Ashpits for Large Terminal

Various Types Studied as Economical Substitutes for Costly Hand Shoveling of Ashes from 150 Locomotives Daily

By W. H. Eiker
District Engineer, C., B. & Q. R.R., Lincoln, Neb.

THE desirability of introducing mechanical operation to improve the ash-handling facilities of the large engine terminal of the Chicago, Burlington & Quincy R.R., at Lincoln, Neb., led to a study of the situation in 1918 and 1919. In November, 1918, a daily average of 108 engines was handled over two parallel cinder pits 150 ft. long with pit tracks 28 ft. c. to c. Between the pits was a depressed track for cars into which the ashes were shoveled by hand, but this method had become expensive and inconvenient because of the labor shortage and the amount of ashes to be handled. The new plant was to be designed to handle the ashes from 150 locomotives daily.

Types of Ashpits—Six types of plants were examined: (1) Water pits; (2) pit cars on lateral incline tracks operated by cable hoists; (3) pit cars traveling on longitudinal track in box pit and delivering to a hoist or conveyor; (4) track hopper delivering to a conveyor or to a car in a tunnel; (5) steam conveyor in pit; (6) pit buckets handled by an electric gantry crane. Some features of these different types are noted below, together with certain objections which were made in most cases by foremen or operators. In general, ashpits of the different kinds are satisfactory to the local officials.

Water-Filled Ashpits—Two types of water pits were examined: (1) Large pits 12 to 15 ft. deep with an engine track over each side; (2) pits between the rails and 3 to 4 ft. deep. In both cases, the ashes are removed by clamshell buckets operated from a locomotive crane or electric gantry crane, the ashes being dumped into cars. These open pits are an element of danger to employees and others, and several fatalities have occurred from persons falling into the large pits. With the track at the side of the pit the fire must be cleaned from one side only, which is inconvenient. Stoppage of pit drainage may cause trouble. Water spilling from the bucket makes an untidy condition and may result in ice-covered tracks in winter, while the wet ashes may freeze in the car and thus add to the expense of unloading. Delays may occur at terminals cleaning over 100 engines daily, as the pits are about 300 ft. long and engines that are wanted in a hurry may be blocked at the pit.

Pit-Car Systems—Ashpits fitted with cars are of two types, with the cars operated either laterally or longitudinally. In the first case the pit car is handled by an electric or pneumatic cable hoist on a steeply inclined track at right angles to the pit, the incline being extended high enough to allow the ashes to be dumped into a railway car placed below the upper end of the incline track. With ashpits of this type, the car must be dumped after each fire is cleaned. Where two or more pits are required they must be spaced 80 to 100 ft. apart along the engine track so as to give ample room for the engines to stand on adjacent pits without fouling each other. This spacing may necessitate an undesirable length of track.

Engines must be moved along the track in cleaning both the smokebox and firebox. The ash car also must be pushed along its track under the incline in order to fill it from end to end. This intermittent movement or spotting of engine and ash car involves time and trouble. Pneumatic operation has proved objectionable in many cases owing to insufficient pressure, leaky piston packing and freezing of pipes. With electric operation this system of handling ashes is economical for terminals with not more than 25 engines daily.

In the second pit-car system the cars travel on a longitudinal track in the pit. They are either picked up by an air hoist which dumps the ashes into a car, or the pit cars dump directly through a hopper to a bucket conveyor which serves an overhead ash storage bin. The former arrangement is used mainly at small terminals, owing to the amount of labor required. In a case where a conveyor was used to handle coal and ashes, the machinery was frequently damaged by scrap metal, so that the conveyor was out of use until repairs could be made. Hot and wet cinders were also destructive to the metal parts of the conveyor, necessitating frequent renewal. In both systems, the pit car must be spotted by hand under the firebox and smokebox, and over-filled cars spill ashes into the pit.

Track Hopper Ashpit—In this system the engine is spotted over a hopper which delivers the ashes either to a bucket conveyor serving an overhead bin, or to a tunnel car serving a hoist for discharge into a bin or a railway car. It was found that with the conveyor there was frequent damage by scrap metal thrown into the hopper with the ashes, while rapid destruction of the machinery was caused by the hot or wet ashes. Tunnel work is undesirable and the work of cleaning fires may be delayed until the hopper can be emptied by dumping the ashes into the tunnel car.

Steam Conveyor—Only a short pit is required for this system, the ashes falling into a pipe across the bottom of the pit and being blown through this under the influence of a steam jet. The pipe may be extended upward for delivery to a storage bin or an ash car, or it may discharge directly onto an ash dump. Objections made may include the amount of steam used and the labor of conveying or shoveling ashes from the pit to the pipe intake. But in one case the pit is hopper shaped so as to feed directly to the pipe and the engines supply their own steam for the jet.

Pit Bucket System—Steel buckets placed in a pit of small cross-section receive the ashes and are handled by the hoist of an electric gantry crane, the ashes being dumped into cars on an adjacent track. This method appears to present no operating objections and when cast steel buckets are used the maintenance charge is almost negligible. It was recommended for the Lincoln terminal.

General Observations—The use of so many different types of ash-handling systems is accounted for by variations in organization of ashpit service, number of engines served, topography and track layout. It is usual to find several different types of ashpits on any one railway. For terminals where not more than 25 or 30 locomotives are cleaned daily the electrically operated lateral incline system has advantages, except that where a locomotive crane is available or is desirable for other work the shallow water-pit may be preferred,

being cleaned by a clamshell bucket handled by the crane.

Removal of ashes from dump pits by clamshell buckets appears to be general. At the larger terminals the buckets are handled usually by an electric traveling crane, but at the smaller terminals a locomotive crane is preferable, as the machine can be used also in coaling engines and for other work. At busy terminals and where track space is limited, the locomotive crane has the objection of blocking one track when cleaning the ashpit.

Organization for ashpit service varies on different roads and at different terminals. At Lincoln, a hostler and helper take over the engine from the road crew at the coaling station; they supply coal and water, knock the fire out at the ashpit and then run the engine to the roundhouse. A shovel gang of about 8 men in summer or 12 men in winter clean the pits. A more general arrangement is to have fire knockers at the pit, these men attending to mechanically-operated pits. In exceptional cases, at very small terminals the hostlers handle the engine, knock fires and clean the pit.

Ashpit for Lincoln Terminal—A plant consisting of a series of cast-steel pit buckets handled by an electric traveling crane having been recommended as the best type of mechanical operation for the Lincoln terminal, a general plan for size of pit and number of buckets was outlined. The plant of the Buffalo, Rochester & Pittsburgh R.R. at Rikers, Pa., was suggested as an economical form of construction, since it has a timber instead of a concrete structure to support the crane track. For the Lincoln terminal, the cast-steel buckets are to be 7 ft. long, with a capacity of 1.85 cu.yd.

It was thought that the new pits should provide for handling a daily average of 150 engines. Investigation showed that an average of 1.7 cu.yd. of ash is taken from each engine. This was based on car measurements from a one-day pit run of about 100 engines. The average weight of the ash was 1,500 lb. per cu.yd., this weight being taken on the day after wetting down and removal from pit. Illinois coal is the fuel used. It is desirable to clean the pits only during the day shift, making the pits large enough to accommodate the ashes from the night run. As the day and night run of engines is about the same, storage capacity for ashes from 75 engines was planned, requiring 69 buckets and 483 ft. of pit. A spacing of 18 ft. c. to c. of pit tracks is desirable to facilitate work on fires and for walking space.

There will be two pits 245 ft. long, with 35 buckets each, on the present pit tracks. The present depressed track will be raised to serve for the ash cars. These three tracks and an adjacent track for kindling-wood cars will be spanned with a 70-ft. electric crane. This plan fits the present track layout and allows for future expansion without track change by building a third pit on the ash car track and using the wood-car track for the ash cars.

Six ash cars are required to hold the ashes from 150 engines and the 245-ft. pits allow this number of cars to be set on the ash track under the crane. Shorter pits would increase the operating charges, as the pit has to be cleaned oftener and more switching of cinder cars is required. With two 245-ft. pits it was planned that a crane operator and one laborer working six hours per day could empty the pit, and only one switching of the ash cars per 24 hours would be required. The number of engines cleaned at this type of pit can be increased by added time for laborer and crane operator and additional switching of ash cars.

Comparison of Operating Cost—This comparison is based on conditions in November, 1918, as to wages and number of engines. The daily average of engines handled over the ashpits during that month was 108. A 48-bucket pit furnishes storage for 54 engines or a 12-hour run. The buckets would be emptied twice in 24 hours and the time required would be four hours for a crane runner. A laborer should be employed at the pit for the entire 24 hours (three 8-hour shifts) for cooling fires, cleaning up around pit and assisting the crane runner to empty buckets. The operating cost per day would be as follows, and on this basis the yearly cost for handling the ash from the mechanically operated pit is approximately $4,600:

Crane runner, 4 hours at 53c.	$2.12
Labor, 24 hours at 35c.	8.40
Electric current, 70 k.w.h. at 3c.	2.10
	$12.62

Operation of the depressed-track pit with hand shoveling required an average daily gang of 10 shovelers working a 10-hour shift and one laborer working 10 hours at night. The daily operating cost was 110 hours at 35c., $38.50, or a yearly cost of approximately $14,000. This charge covered office overhead expense, car-body bunk houses for Mexican labor, and light, heat and water for living quarters. A foreman's time is not considered in this comparison as his time is distributed between ashpit, coaling station and other duties and he would be required at any pit. The mechanically operated pit will relieve him of one large gang.

Serious conditions have occurred because sufficient shovelers could not be had. The pits filled with ashes and it was necessary to take men from other work to clean the pits. The investigation noted above showed that there is no economic argument for hand shoveling of engine ashes at large terminals. After this investigation the Chicago, Burlington & Quincy R.R. constructed at Denver, Colo., a mechanically operated ashpit of the type recommended for Lincoln (see *Engineering News-Record*, Aug. 25, 1921, p. 310) and plans are now being made for a similar plant for the engine terminal at Lincoln, Neb.

Activities of British Guild of Builders

(*London Correspondence*)

According to its secretary the British National Guild of Builders commenced operations eighteen months ago without a penny of capital and without a cent's worth of plant. Since then they have spent £52,000 on plant, and have written off 33⅓ per cent of its value, though much of it is almost unused. The surplus actually earned is now £40,000, and £20,000 is held by city corporations pending the completion of contracts.

The original form of contract is still adhered to, by which the guild constructs houses at prime cost plus 6 per cent and £40 per house completed. At the time of the agreement with the Ministry of Health this showed a gross profit of around 10 per cent.

The guild has undertaken £1,500,000 worth of contracts, of which £900,000 represents work completed and paid for. During this year lump sum contracts awarded the guild amount to £700,000 of which £130,000 is for work which has been completed.

LETTERS TO THE EDITOR

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

From Another Engineer's Wife

Sir—Several weeks ago "Engineer's Wife" passed a just condemnation on the unwarranted use of the professional title by the layman engineer. Every engineer has met with such hypocrites of his profession, but the individual can do nothing to prevent this presumption upon one of the noblest professions on earth. Perhaps this laxness goes back to the fact that not so very many years ago America could use every man that knew ever so little about the profession. Europe has always produced more than enough to supply her demand for engineers. Consequently, a great many came to this country. There was nothing to prevent the would-be engineer from assuming the title of the graduate, for few employers looked up past records.

After all, he only fools himself who claims the engineer's title when he does not merit it. It is the results of your work that count, not the mere title after your name. It never takes very long for the boss to find out whether or not the man can do his work.

(Mrs.) SOPHIA GOOMS-BUCHER,
Chicago, Ill., June 3. (Another Engineer's Wife.)

Bureau of Standards on Radio Dangers

Sir—Our attention has been called to the editorial appearing on page 812 of *Engineering-News Record* for May 18, entitled "Shingles and Radio." We assume that your editorial makes reference to a press notice released under date of May 14, in which mention is made of the proposed revision of Rule 86 of the National Electrical Code, on radio equipment. Full discussion of the provisions of this proposed rule is very welcome, and it is believed that such discussion will result in calling attention to any features in the rule which are not practical or desirable. We are glad to note the statement in your editorial that the proposed rule is "moderate, sane and practical in the highest degree." The requirements of the proposed rule are less rigid, in a number of particulars, than are the corresponding requirements for other signaling systems.

Your attention is called to the fact that the press release pointed out that a failure to give cognizance to the proposed fire-insurance rules for radio equipment might result in the raising of insurance rates on property or the refusal of insurance entirely. It was not specifically a warning against lightning danger. There are other sources of danger in radio installations which may, in some cases, be more important than the lightning hazard.

The very existence of the need for a rule on radio equipment, such as that which has been drafted by the committee of the National Fire Protection Association, is in itself a suggestion that consideration must be given to such hazard as may exist.

In this connection your attention is drawn to the fact that within the last few weeks two deaths have resulted in the city of Cleveland, which, according to our understanding, could have been avoided if the proposed regulation had been followed. The cities of Cleveland, Detroit, Indianapolis and Chicago, among others, are enacting local ordinances on this subject, many of which are extremely drastic, and not nearly so lenient as the proposed revision of the Code rule. It is believed that rules regarding the safe installation of radio equipment should be as uniform as possible over the country, and it is therefore highly desirable that the proposed revision of the National Electrical Code in this respect receive careful consideration and discussion.

T. C. BROWN,
Acting Director, Bureau of Standards.
Washington, June 7.

Simple Formulas for Rivet-Hole Deductions

Sir—In your issue of June 1, p. 911, under the heading "Net Section of Riveted Tension Members," there appears a summary of a bulletin on the subject by Prof. C. R. Young. As a conclusion of his study of previously published discussions, Prof. Young recommends as a practical formula for rivet-hole deductions:

$$x = 1.50 - 1.25\ s/g$$

Where s is the stagger or longitudinal distance, and g is the gauge or transverse distance between rivets.

Two years ago, after a review of previously published studies, the writer submitted to the Bridge Engineers Committee of the New York Central Lines a similar but simpler formula: $x = 1.3 - s/g$. This formula yields values which agree closely with the results of published reports of rivet tests.

Both formulas (Prof. Young's and the writer's) are close practical approximations to the requirements of exact theoretical analysis. The adoption of either one would eliminate the inconsistent and anomalous results yielded by existing specifications for rivet-hole deductions.

The writer's formula, while yielding practically the same values as Prof. Young's, appears easier to apply. In his contribution to the discussions on the "Tentative Specifications for Steel Railway Bridges," published in the April *Proceedings* of the American Society of Civil Engineers, the writer recommended a specification for net-sections substantially as follows:

"In a zig-zag section across a member, deduct the full area of the first hole and a fractional part of each succeeding hole, the fractional part being determined by the formula $x = 1.3 - s/g$."

D. B. STEINMAN,
New York, June 6. Consulting Engineer.

[Attention is called to a typographical error in the note on Prof. Young's paper. The practical formula recommended by him should read $x = 1.50 - 1.25\ s/g$, as correctly quoted by Dr. Steinman in the preceding letter.—EDITOR.]

The Case of Shingle Roofs

Sir—This is to call your attention to the impression created by the editorial "Shingles and Radio" appearing on page 812 of *Engineering News-Record* of May 18. While doubtless there may be good reason for your "wolf" illustration, we submit that the matter of the danger of shingle roofs is not a well chosen illustration.

The conflagration hazard involved in a city of shingle roofs has long been recognized and all too often demonstrated. The shingle furnishes both the fire-brand to spread a conflagration and the tinder which is ignited by sparks. The Paris, Tex., and Nashville, Tenn., conflagrations are typical of many other shingle-roof fires which might be cited.

As recently as April 28 we had a striking example of the danger residing in shingle roofs. On this date there was a fire in Lynn, Massachusetts. The following day the Boston Post carried the headline "Change of Wind Keeps Lynn on the Map." This fire started in a wooden shingle-roof tenement district, and spread, because of shingle roofs, for half a mile along the waterfront, igniting some 38 dwellings and other structures. It is said that only the fact that the wind carried the shingle fire-brands over the water and away from the city "kept Lynn on the map."

In this connection the statements of Frank Jordan of the Indianapolis Water Co. before the recent convention of the American Waterworks Association are of interest:

> During the months of January and February of this year, our city had occasion to realize the absolute necessity of the elimination of the shingle roof, which according to our fire chief is our greatest fire hazard. We have approximately 60,000 buildings covered with wooden shingle roofs, and during the first two months of this year we had 850 shingle-roof fires, the maximum number for any one day being on Feb. 16, when we had 63 fires, every one of which was due to defective flue or sparks on a shingle roof. We have at this time a city ordinance which prohibits the use of wooden shingles on new buildings and provides further that if 50 per cent of a roof is damaged the entire roof must

be replaced with a fire-resistant roof. This ordinance, however, fails to specify a time when all shingle roofs must be replaced with fire-resistant roofs, and the change is therefore very slow. A great many of the cities over the country have rigid ordinances in reference to shingle roofs, and the value of these ordinances will be realized when we compare our record of more than 1,200 shingle-roof fires in 1920 with a record of New Orleans, where there were 24; Cincinnati, 56; Louisville, 110; St. Paul, 99, and Philadelphia, 110.

We know that you realize the importance of and take a decided interest in fire prevention and fire protection. We always follow with interest the excellent articles and editorials which you publish from time to time on these subjects. We hope that you may come to appreciate the importance of the use of non-flammable roof covering as a fire protection measure.

Boston, June 9. R. S. MOULTON,
Assistant Secretary, National Fire Protection Association.

Skew Arch Theory Imperfect

Sir—Referring to the letter of Daniel Royse in your issue of June 8, p. 968, concerning my article on skew arches, I will say that there are many points yet to be cleared up in skew arch theory. A small experimental arch which we tested proved conclusively the incorrectness of the usual method of calculation. In my article I also called attention to the fact that the results of this test could not be made to agree with Dr. Fischer's theory and made the statement that further tests are necessary to determine the amount of the component parallel to the abutment and the method of taking this into account in the calculation.

It is to be hoped that the experiments now under way will shed some light upon this point. CLYDE T. MORRIS,
Columbus, June 10. Engineer, Ohio Stadium Building Committee.

Observed and Computed Friction in Pier Test

Sir—In the article "Load Tests of Piers for Chicago New Union Station," Mar. 18, p. 822, I was surprised to find no attempt at a comparison between theory and experimental results. The experiments are valuable for the job at hand, but they can also be reduced to a form in which they may be of value to others.

The skin friction on a concrete cylinder of 4 ft. diameter, 70 ft. deep, was found to be equivalent to 315 tons, including the dead weight. The soil was saturated clay. This friction, corresponding to 25 tons or 50,000 lb. per foot width, is caused by the normal pressure of the soil and is in all probability the friction of clay on clay, and not clay on concrete. Since the coefficient of clay on clay is less than that of clay on concrete, the pores of the pier will soon be filled and its surface entirely coated with clay. The normal pressure on the pier is the passive resistance of the clay to pressure (often called the "passive pressure"), which by the Rankine formula is $P = \frac{1}{2}\, yh^2\left(\frac{1+\sin\phi}{1-\sin\phi}\right)$.

In the present case h in 70 ft., y is 80 lb. per cu.ft. (very approximately for wet clay), and the vertical friction, 50,000, is $P \tan \phi$, where ϕ is the angle of friction of clay on clay. This is in accordance with the principle of normal and frictional forces at the point of equilibrium. The formula then gives

$$50{,}000 = \tfrac{1}{2}\, yh^2\, \frac{1+\sin\phi}{1-\sin\phi} \tan\phi.$$

the solution of which is $\phi = 10° 10'$, corresponding to a coefficient of friction of about 0.18. It would be interesting to know whether the coefficient of friction of the material was obtained. The computed value is very close to the usual value of the coefficient of friction for wet clay, as given in the handbooks. JACOB FELD.

University of Cincinnati,
May 27.

A Challenge to Accepted Theories of Highway Finance

Sir—I have read with much interest and profit Dr. Haig's "A Challenge to Accepted Theories of Highway Finance," in *Engineering News-Record* of May 11, p. 790.

That the position which the State of Maryland has taken in connection with road maintenance is gradually coming to be adopted is, we believe, a tremendous step toward the solving of the highway transportation problem of today. When I presented a paper before the American Association of State Highway Officials at Washington in December, 1920, I advocated that all resurfacing of highways be charged to maintenance and that the word "reconstruction," as used previously, be eliminated from highway bookkeeping. It is interesting to note that not a single member of any state highway department agreed that this was proper.

That long-term bonds under this theory of financing are sound cannot be doubted, but the ability to pay for this resurfacing when such long-term bonds must be resorted to for construction is a question of very serious doubt in our minds. The greatest fallacy in the argument which I have heard put forth for long-term bonds is in the fact that it is all predicated upon a system of highways not in excess of 7 per cent of the total. We are convinced that no such figure as this begins to meet the demand. In Maryland today we have a system in excess of 15 per cent and we know that the roads which are essential to Maryland's development and progress have not yet been developed—I doubt if they have been half completed.

If it is true that it is necessary to borrow money on bonds for road construction not in excess of 7 per cent of the total, and if it is true that the next generation will require as many additional roads as does this generation, and unto the third and fourth generations, is it not necessary that each generation pay as it goes?

Maryland's system of financing both construction and maintenance is identical with the conclusions of Dr. Haig, except that we believe in 15-year bonds rather than 50-year bonds. The reason our conclusions differ on 50-year bonds is because we differ in the premises as to what constitutes an adequate highway system. J. N. MACKALL,

Baltimore, June 10, 1922. Chairman and Chief Engineer, State Roads Commission of Maryland.

Treatment of Strong Sewage in India

In "The London Surveyor" for May 12, 1922, F. C. Temple, chief town engineer to the Tata Iron & Steel Co., Ltd., Jamshedpur, has the following interesting comment on sewage practice in India:

The practice has been growing among sanitarians in India of calculating the size of sewage-works by the number of people that they are to serve. This would appear to be a logical process anywhere, for the purpose of any sewage-works is to oxidize a certain quantity of putrefactive organic matter to such a point that it will be non-putrefactive and harmless. The quality of putrefactive matter present will depend upon the number of users or persons served. Within certain limits of dilution, the size of the septic tanks and filters to oxidize the putrefactive matter will depend on the number of users. I have carried out a series of experiments extending over some six years, which indicate that, for the size of septic tank and filter found most useful in India, the maximum dilution is 40 gal. per head [Imperial gallons] and the minimum 5 gal. per head. With less dilution than 5 gal. per head the necessary changes do not take place; with more than 40 gal. the sewage passes through the tank as an emulsion—too rapidly for the changes to take place. Within these limits of dilution, sewage can be treated successfully in septic tanks with a capacity of 2 cu.ft. per user (including the grit tanks), the effluent from which is treated by filters having 3 cu.ft. of filtering material per user—provided that the final effluent can be discharged into a large river or somewhere on land.

NEWS OF THE WEEK

New York, June 22, 1922

Am. Soc. C. E. Directorate Elects Society Secretary

Also Authorizes Technical Division—Action on Joining Federation Deferred Until Fall

(Engineering News-Record Staff Report)

The most important action of the Board of Direction of the American Society of Civil Engineers in its two-day session prior to the annual convention of the society at Portsmouth, N. H., June 21-22, was the election of John H. Dunlap, of Iowa City, Ia., as secretary, establishment of technical divisions of the society, and a step toward the settlement of the question whether the society should join the Federated American Engineering Societies. Prof. Dunlap, of whom a biography appears elsewhere in this issue, accepted his appointment in the following telegram: "Your notification of my election as secretary just received. This high honor is valued beyond expression and I accept this great trust in sincerest humility of spirit and only in the hope that I may be able to serve our common cause worthily." Prof. Dunlap has had long experience in society conduct in his home state, having been secretary and later president of the Iowa Engineering Society and is now the president of the Iowa section of the American Society of Civil Engineers.

Technical Divisions Authorized

In authorizing technical divisions the Board of Direction adopted by-laws which permit the formation of such sections on the application of 20 members, the division then being authorized to include non-members in its activities. At the Portsmouth meeting four technical sections were authorized—in sanitary, irrigation, power and highway engineering. The manner of functioning of these divisions will have to be worked out later.

The question of joining the Federation was discussed informally by the board, which finally adopted a resolution that it be considered at the San Francisco meeting, and that the secretary and the president of the Federation be invited there to discuss the matter.

The question of advertising in the society's publications was postponed.

The following elections to honorary membership in the society were announced: Clemens Herschel, hydraulic engineer, New York; John F. Stevens, president, Inter-Allied Technical Board, Harbin, Manchuria; W. C. Unwin and Sir Maurice Fitzmaurice, distinguished British engineers; and M. Chagnaud, president, Société Française des Ingénieurs Civils.

The Board of Direction passed a resolution asking Engineering Foundation to make a thorough study of engineering society organizations and urging other societies to join in that request.

The Committee on Licensing promised a report at the next board meeting.

American Construction Council Organizes

Fifty-four Associations Represented—Program Partly Outlined—Franklin D. Roosevelt Elected President

(Engineering News-Record Staff Report)

With an attendance of more than 200 men interested in the construction industry, representing 54 associations, the American Construction Council, under the initial chairmanship of Secretary of Commerce Herbert Hoover, was formally organized in Washington, D. C., June 19. The responses of the spokesmen of the various groups were without exception expressions of appreciation of the magnitude of the council's opportunity and of confidence in the ability of the interests represented to bring it to success. By-laws, tentatively drawn up at Cleveland two months ago, were amended and adopted, an executive board elected and a program endorsed and referred to the executive board for its consideration, modification and action.

Opening Session

The opening session was devoted to addresses outlining the purposes and opportunities of the council. Secretary Hoover, after enumerating the many things to be done placed great stress on the need for industry to govern itself. Otherwise, if there be abuses, there will be public control through government agencies. He believed that the council would help to stabilize the industry and to eliminate undue speculation. He characterized the movement as "one of the most important steps taken in the history of the industry."

The need for the industry to square its conduct with the interests of the public was the burden of the address by Willis H. Booth, vice-president of the Guaranty Trust Co., of New York. He protested against what he termed the "stratification" in American economic life—the setting off of interests into groups for the attainment of selfish objects. The council would make the industry articulate and enable it to interpret itself to the bankers, to the transportation interests, to the industries and to the public.

Mr. Booth's talk was followed by short addresses by the representatives of the various groups: Henry H. Kendall, of Boston, for the architects; Thomas H. MacDonald, of Washington, for the federal, state and city construction departments; Calvert Townley, of New York, for engineers; Frederick L. Cranford, of Brooklyn, for general contractors; John R. Alpine, of New York, for sub-contractors; John Donlin, of Washington, for labor; M. T. Bannigan, of Utica, N. Y., for dealers in materials and equipment; William McClellan, of New York, for public-utility construction departments; and Ralph F. Proctor, of Baltimore, for banking, insurance and real estate interests.

Mr. Kendall counseled that controversial questions be studiously avoided at the start. Mr. MacDonald believed that highway building was now so well organized that it could be used as a balance wheel to fill up in part the depressions in the business cycle. Mr. Donlin pointed out how the misconduct or disruption of one element of the industry affected every other element.

Work for the Council

Much of the second day of the meeting was taken in discussions of work that the council might do to further the aims of the several groups. Robert D. Kohn, architect, of New York, urged the need of establishing conferences to bring together locally all the interests that the council is endeavoring to bring together nationally. He cited the success of the local building congress at New York, Boston, Seattle and Portland, Ore. The New York congress has been instrumental in having the city educational authorities establish an apprenticeship system. It has also adopted a code of ethics for the industry. The Boston congress has done its best work on the mitigation of seasonal unemployment.

M. C. Rorty, vice president of the American Telephone and Telegraph Co., New York, believed that the council should gather statistics from which a reliable set of index figures of construction cost, of volume, and of future work could be prepared.

John M. Gries, chief of the Building and Housing Division of the Department of Commerce, speaking on the same topic as Mr. Rorty, condemned severely the inadequate collection of statistics, characterizing as "lies" those statistics in which estimates play a large part. He believed it necessary to develop statistical sources in each of the moderate and large-sized cities of the country, sources that were dependable, thorough, and that would have no reason for desiring to color the statistics by making choice of data.

John B. Larner, president of the Washington Loan and Trust Co., dealt with the need of establishing moral standards in industry, a matter more fully developed later by F. M. Feiker, vice president of the McGraw-Hill Co., in an address on the "Need of a Vital Code of Ethics." Both speakers pointed out the benefit that would flow to the public from adherence to high standards, and Mr. Feiker emphasized the necessity for local machinery for enforcement if tangible results were to be attained.

Walter Gordon Merritt, attorney, of New York, speaking on "Determining the Proper Relations Between the Several Elements of the Construction In-

dustry," made one of the hardest hitting speeches of the meeting. The council, in his judgment, must so function that constant co-operation between employer and employee must replace the "periodic armistices" which are now the history of their relations. He declared that the trouble with the industry now is due not to lack of organization, but to organization with selfish motives. The council must replace selfishness by a sense of responsibility to the public. Finally he declared that our acute building troubles in certain cities have been due to "bargaining with corruption" because such bargaining was the easiest way of carrying on business. The council, he contended, must meet this situation and remove and prevent corruption instead of permitting the industry to bargain with it.

By-Laws

On the first afternoon the groups met separately for the consideration of the proposed by-laws and for the selection of their representatives on the executive board. At the evening session several of the groups reported amendments, but the main framework proposed for the organization was left undisturbed. An additional group, No. 11, composed of the National Association of Builders' Exchanges, the Building Trade Employers Association, the Federation of American Plan Associations and similar bodies containing both general and subcontractors, was established. The executive board was given power to establish still other groups. The number of representatives of each group in the executive board was increased from two to four. After these and several other amendments of detail had been made, the by-laws were unanimously adopted, thus bringing the council into existence.

The cardinal feature of the council's organization is that it includes all the elements of the industry and that each has the same voting power. The groups, beside No. 11, referred to above, are: Architects, engineers, general contractors, sub-contractors, construction labor, manufacturers, dealers; financial, bond and insurance interests; public utility construction departments; construction departments of federal, state and municipal governments.

Executive Board Members

Elections to the executive board resulted in the following choice:

Architects: Abram Garfield, Cleveland; D. K. Boyd, Philadelphia; S. W. Parker, Boston; R. D. Kohn, New York City.

Engineers: C. T. Main, Boston; B. J. Arnold, Chicago; Peter Junkersfeld, New York; C. F. Loweth, Chicago.

General contractors: W. O. Winston, Minneapolis; F. L. Cranford, New York; N. F. Hoggson, New York; H. H. Wilson, Muncy, Pa.

Sub-Contractors: A. E. Coleman, Chicago; J. R. Alpine, New York; Benjamin Dickinson, Bedford, Ind.; Oscar A. Reum, Chicago.

Construction Labor: John Donlin, New York; John Coefield, Chicago; John J. Hynes, Chicago; J. C. McSorley, Cleveland.

Manufacturers: W. D. Goss, New York; W. M. Wood, Decatur; Wm. Ritter, Columbus; F. W. Walker, Beaver Falls, Pa.

Dealers: W. T. Rossiter, Cleveland; E. L. Jahncke, New Orleans; John E. Lloyd, Philadelphia; M. T. Bannigan, Utica.

Financial, bond and insurance interests: W. H. Booth, New York; Harry Wheeler, Chicago; I. B. Hiett, Toledo.

Public utility construction departments: Gano Dunn, New York; Francis Blossom, New York; Joseph Alexander, Cleveland; C. H. Markham, Chicago.

Federal, state and municipal construction departments: Paul D. Sargent, Augusta, Me.; John M. Gries, Washington; C. M. Upham, Raleigh, N. C.; R. P. Miller, New York.

Building exchanges: W. F. Chew, Baltimore; Walter Klie, Cleveland; D. T. Riffle, Pittsburgh; G. C. Mills, Webster City, Iowa.

The Committee on Program rendered a report at the closing session, merely listing the important subjects which the council might take up. These included: Formulation of a code of ethics for the industry, collection of statistics, en-

(Continued on p. 1057)

Dunlap Is New Secretary of Am. Soc. C. E.

John H. Dunlap, professor of hydraulics and sanitary engineering, State University of Iowa, Iowa City, president of the Iowa Engineering Society and of the Iowa Section, Am. Soc. C. E., was elected secretary of the American Society of Civil Engineers by the Board of Direction at its meeting during the annual convention at Portsmouth, N. H., this week. He became an associate member of the society April 17, 1917, and a member June 6, 1921. The new secretary succeeds to the office left vacant by the retirement of Dr. Charles Warren Hunt in 1920 and filled since that time in succession by Herbert S. Crocker and Elbert M. Chandler, with the title of acting secretary.

Prof. Dunlap, in addition to his university work, has devoted part of his time to private practice as a civil and sanitary engineer. He is 40 years old, having been born at Harrisville, N. H., Sept. 9, 1882. He was graduated from the Thayer School of Civil Engineering at Dartmouth College in 1908 after having received his A.B. degree at that institution in 1905. For a short period in 1905-6 he served as chairman and levelman in Nevada on the Truckee-Carson project of the U. S. Reclamation Service, returning to college to continue his engineering studies. During the summer of 1907 he joined the engineering corps of the Indianapolis Division of the Pennsylvania R.R., with headquarters at Columbus, Ohio, and the following year served as field instructor in surveying at the Thayer School.

After graduation he joined the faculty of the State University of Iowa as instructor in descriptive geometry and was promoted until he became professor of hydraulics and sanitary engineering in the College of Applied Science at that institution. He filled a summer engagement in 1914 with the Extension Division of the university and since 1915 has done consulting work in the civil and sanitary engineering fields.

Franklin D. Roosevelt Heads Construction Council

Franklin D. Roosevelt, former Assistant Secretary of the Navy, whose election to the presidency of the American Construction Council is announced in another column of this issue, is a lawyer by profession and has been active in a wide variety of public affairs. He was born in Hyde Park, Dutchess County, N. Y., Jan. 30, 1882, was graduated from Harvard in 1904, and from the Columbia University Law School in 1907. Admitted to the New York bar during the year of his graduation, he began practice with the firm of Carter, Ledyard & Milburn of New York, where he remained until he joined the firm of Ennet Marvin & Roosevelt, formed in 1910.

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FRANKLIN D. ROOSEVELT

As a political figure Mr. Roosevelt received recognition in 1910 when he was elected a member of the New York State Senate, resigning three years later to become assistant secretary of the navy. He was the candidate on the Democratic ticket in 1920 for the vice-presidency of the United States, he and Governor Cox, of Ohio, being defeated at the polls in November of that year by the Republican nominees, Harding and Coolidge.

His activities during and after the war included inspection of the U. S. naval forces in European waters from July to September, 1918, and of demobilization in Europe in January and February, 1919.

Mr. Roosevelt is at present vice-president in charge of the New York office of the Fidelity & Deposit Co. of Maryland.

Dissolves Injunction Against Narrows Tunnel

The temporary injunction obtained by the Citizens Union against the building of the Narrows freight and passenger tunnel by the City of New York has been dissolved. The Court takes the ground that the need for the tunnel was decided by the enabling legislation and that questions of construction are within the discretion of the city Board of Estimate and Apportionment.

John A. Bensel

Former State Engineer of New York and Past President, Am. Soc. C. E., Died June 19

John A. Bensel, formerly state engineer of New York and past-president of the American Society of Civil Engineers, died at his home in Bernardsville, N. J., June 19. For many years he had been a prominent figure in the public affairs of both the state and the city of New York and had been mentioned as a candidate for mayor and for governor. His professional experience dealt largely with the design and construction of water-front improvements and he served under Mayor McClellan as commissioner of the New

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JOHN A. BENSEL

York City Department of Docks and Ferries, and later as chairman of the Board of Water Supply of the City of New York.

Mr. Bensel was born in New York City, Aug. 16, 1863, was graduated from Stevens Institute of Technology in 1884, and began engineering work with the Croton Aqueduct Commission. A year later he went with the Pennsylvania R.R. as rodman and during four years with that organization was advanced to the rank of assistant supervisor of the New York Division, a position from which he resigned in 1889 to become assistant engineer in the New York Department of Docks. Here he remained six years and was promoted to assistant engineer in charge of construction. He resigned in 1895 to enter private practice, specializing in water-front improvements and valuation work connected therewith.

In 1898 Mr. Bensel became chief engineer of the New York Department of Docks and Ferries and under his direction the Chelsea docks, as well as extensive works on the water front of Brooklyn, were designed and constructed. After seven years' service as as the head of the department's engineering forces he was appointed dock commissioner, a position which he retained for two years.

In January, 1908, Mr. Bensel was appointed president of the New York Board of Water Supply, which was then beginning the construction of the 92-mile Catskill aqueduct to deliver to New York City a daily supply of 500,000,000 gal. of water, involving an initial expenditure of $160,000,000.

The Democratic State Convention, in 1910, nominated Mr. Bensel for the position of state engineer and surveyor, and he was elected in November of that year for a two-year term, and re-elected for a similar period in 1912. In this capacity he had charge of the New York State Barge Canal work.

Evidence of the high regard in which he was held by his professional associates was furnished in 1910 when the American Society of Civil Engineers chose him for its president.

Following the termination of his duties as state engineer in 1915, Mr. Bensel had been engaged in private practice in New York. He served as a member of the board of consulting engineers on the Hudson River vehicular tunnel until the board was abolished by resolution of the New York and New Jersey tunnel commissions this year. During the war he was commissioned a major, Engineers, and was assigned to duties involving cantonment construction in the United States.

Buffalo Invites Bids for Garbage-Disposal Land and Plant

Bids for land and for plant for the disposal of the garbage of Buffalo, N. Y., (1) by feeding to hogs with either an incinerator or a reduction plant of 50 tons daily capacity to dispose of the residue, or (2) by either incineration or reduction of all the garbage, the plant to have a daily capacity of 200 tons, are desired up to 11 a. m., July 25, by Arthur W. Kreinheder, Commissioner of Public Works.

Bidders for a disposal plant, by either method, must submit detailed plans showing the method proposed, cost per ton, commercial value of the residue, names of cities where similar plants are located, and a guarantee that no obnoxious gases or odors will be created through the operation of the plant.

Acknowledgment for a Photograph

The view of the Poydras crevasse published on page 868 of the issue of May 25 was furnished *Engineering News-Record* by courtesy of the New Orleans *Item*. Inadvertently this acknowledgment was left out of the original article.

Cement Trial Date Not Set

The report recently emanating from the Department of Justice, Washington, D. C., to the effect that the criminal trial against the Midwest cement manufacturers was to begin on June 15 as reported in *Engineering News-Record* June 8, p. 970 was in error. According to the best information available no date has been set either for the trial of Midwest cement manufacturers or for a re-trial of eastern manufacturers. However, in view of the fact that tedious criminal cases of that nature are usually not prosecuted during the summer months, it is quite possible that both cases will go over until fall.

Prof. Prescott Succeeds the Late W. T. Sedgwick at M. I. T.

Prof. Samuel C. Prescott, whose appointment as head of the Department of Biology and Public Health at the Massachusetts Institute of Technology to succeed the late Prof. W. T. Sedgwick was officially announced on June 8, graduated from the Department of Chemistry at M. I. T. in 1894 and then became assistant chemist and bacteriologist at the Worcester (Mass.) sewage purification works. The following year he was Prof. Sedgwick's private assistant and in 1896 he became instructor in biology at the institute, progressing to the grade of professor of industrial microbiology in 1914.

During this period he had charge of the instruction in bacteriology, especially as it applies to the examination of water, sewage, milk and foods, and developed a course in the industrial applications of bacteria and other micro-organisms which was the first of its kind given in the United States. In 1900 he spent several months studying and inspecting methods in laboratories in Germany, Denmark and Belgium.

In 1905 Prof. Prescott established the Boston Bio-Chemical Laboratory, devoted to the study of commercial problems relating to bacteriology, fermentation and food chemistry. He was director of this laboratory until 1921 when he gave up its active management on account of the increasing work at the institute. From 1914-17 he had charge of a research laboratory devoted to problems of agriculture and bacteriology and plant disease control for the United Fruit Co. in Central America.

Soon after the United States entered the war Prof. Prescott was commissioned a major in the Sanitary Corps. One of his most important duties was the inspection of food storage in the large quartermaster supply warehouses in the training camps. In this duty he visited nearly all the large camps east of the Mississippi.

Since the death of Prof. Sedgwick, in January, 1921, Prof. Prescott has served as acting head of the department of which he now becomes head.

May Not Move Denver Office of Reclamation Service

(Washington Correspondence)

While no decision has been rendered by the Secretary of the Interior in connection with his proposed discontinuance of the Denver office of the U. S. Reclamation Service and its consolidation with the office of the service in Washington, the impression prevails that the proposal will not be put into effect. When the consolidation proposal became known, it resulted in such widespread protest that Secretary Fall stated that he would hold the matter in abeyance for the time being. It is believed that he hardly will insist on the consolidation, in view of the representative character of the opposition.

Wasser Named President of Road Builders

Adjourned Annual Meeting Declares This Year's Directors Illegally Elected

After several hours of heated discussion, punctuated by motions for adjournment and appeals from the decision of the chair, the annual meeting of the American Road Builders' Association held in New York City, June 15 (adjourned from May 15), received from its board of directors an announcement of the election to the presidency of Thomas J. Wasser, state highway engineer of New Jersey, as successor to Lt.-Col. H. L. Bowlby. The board's action broke the deadlock which ended the May 15 meeting with a tie vote between Mr. Wasser and Col. W. D. Uhler, state highway engineer of Pennsylvania.

The adjourned annual meeting, acting upon the unanimous recommendation of the directorate, declared illegal the election of directors announced a month ago, as reported in *Engineering News-Record* of May 18, page 843. This action was based on evidence produced showing that two violations of the constitution had occurred, the first in the failure of the Nominating Committee to send the results of its choice to the secretary sixty days before the annual meeting, and the second by the secretary in failing to send out letter ballots to the membership at least thirty days before the date of the annual election. During the current year, therefore, the board will continue with its old membership minus those directors whose terms of office expire this year.

Clash Over Balloting

The first clash at last week's meeting occurred when Major F. A. Reimer offered a resolution calling upon the secretary to announce the result of the total number of ballots cast by the directors up to June 15 for the office of president. This motion was seconded and in the discussion it was brought out that while a tie vote of 14 to 14 had occurred at the May 15 canvass of votes, two ballots had subsequently been received which, it was stated, would elect Mr. Wasser. Col. H. L. Bowlby, president of the association, ruled the motion out of order. Major Reimer disagreed on the ground that the June 15 meeting was an annual meeting adjourned from May 15 and was, therefore, not a new session but in reality a continuation of the former. Col. Bowlby, however, remained obdurate and on an appeal from the decision of the chair Major Reimer won his point, but the chairman still refused to call for a vote on the resolution on the ground that he considered it "frivolous." He maintained that the poles had closed on May 15 and that therefore no other votes could be received. A bitter exchange of opinion followed. When Secretary E. L. Powers was called upon to clarify the question of fact as to the receipt of additional ballots, he contributed only the information that he didn't remember about them.

Ten days prior to the adjourned meeting on June 15 new blank ballots for the vote on president had been sent out by the secretary. The chairman called upon the meeting to recess, in order to give the board of directors an opportunity to meet and canvass the ballots for president. Col. Bowlby here injected a new phase into the situation by presenting a written statement announcing that in spite of the wishes of some of his friends he had not been and was not now a candidate for re-election to the presidency. Following this statement, S. T. Henry, of the Allied Machinery Co., asked Col. Bowlby the pointed question whether or not he would actually accept the presidency if a canvass of the votes by the board indicated his election.

"That is a personal question," replied Col. Bowlby, "I do not care to answer."

Again the discussion turned to the Reimer resolution and the two uncounted ballots and after pleas for harmony had been made by James H. MacDonald and Irving Patterson, the meeting recessed to enable the directors to meet and vote. After half an hour's deliberation it was announced that of 27 votes cast, Mr. Wasser had received 15, while 12 had gone to other candidates.

In accepting the presidency Mr. Wasser urged that old differences be buried and that co-operation be the slogan in the future.

Thomas J. Wasser

Thomas J. Wasser, whose election to the presidency of the American Road Builders Association is noted elsewhere in these pages, has had an experience of thirty-two years in general construction, railroad and highway work. He was born in Philadelphia in 1871 and at the age of 21 began work on macadam highway construction with B. M. and J. F. Shanley, general contractors of Newark, N. J. During the next few years he served with the Long Island Railroad, with the Consolidated Traction Co. of Jersey City, and with the Sanford & Stillman Co., general contractors and bridge builders of Jersey City, acting with the latter organization as foreman in charge of building the Harlem transport freight yards at 135th Street, New York City, piers for the Lehigh Valley R.R. at Jersey City, and buildings for the United Gas Improvement Co.'s plant at East Chester, N. Y.

Beginning in 1899 he spent four years with Robert W. Hunt & Co., engineers, New York, on mill, shop, and erection inspection, and in 1903 was appointed by James Owen, Essex County engineer, and J. W. Leahy, Hudson County engineer, to assume charge of preliminary work for the Hackensack bridge and Newark plank road, and later was placed in charge of this construction. Mr. Wasser also directed the construction of the 14th St. viaduct in Hoboken.

Mr. Wasser became engineer of Hudson County in 1913 and designed and constructed most of the Newark turnpike. Resigning that position in 1920 he was selected by the reorganized State Highway Commission to be state highway engineer of New Jersey. In addition to membership in a number of the national engineering societies, he is president of the New Jersey Board of Professional Engineers and Surveyors.

The Engineer in Public Life

HARRISON W. FITZGERALD

Citizens of Hamburgh, N. Y., a suburban town outside of Buffalo, recently elected Harrison W. Fitzgerald, chief engineer of the Donner Steel Co. of Buffalo, N. Y., as mayor for the coming year. Hamburgh is confronted with two municipal problems: one, the construction of a sewer system and a sewerage disposal works and the other either the building of a new and adequate water supply system which now chase and rehabilitation of the system which now supplies the town. With these questions before them the citizens thought that a professional engineer would be their best choice as head of the incoming board of trustees. That this sentiment was held generally was evidenced by the fact that no other candidate contested either the nomination or election of Mr. Fitzgerald.

Mr. Fitzgerald has had an extensive experience in the engineering of the steel industry. Before assuming his present duties with the Donner company, he was associated respectively with Garrett-Cromwell Co. of Cleveland, the Illinois Steel Co. at South Chicago and the Lackawanna Steel Co. at Lackawanna, N. Y.

He is a charter member of the Buffalo Chapter, American Association of Engineers, and is one of the pioneers who organized the original American Association of Engineers Club to which he contributed his services as secretary.

House Minority Report Scores Ford Muscle Shoals Offer

A new minority report, submitted to the House by the House Committee on Military Affairs, entirely repudiates Ford's offer in regard to the purchase and operation of the Muscle Shoals property and recommends that the federal government continue the work on Dam 2 and lease, not sell, Nitrate Plants 1 and 2. The report also recommends that any lease for use of power be executed in accordance with the provisions of the Federal Water-Power Act, and that as there is no apparent reason for the present construction of Dam 3, it be not built.

The report points to the large money loss to the federal government in accepting the Ford offer, and to the total lack of any provision in the Ford offer that he will continue to manufacture fertilizers at Muscle Shoals during even a small part of the 100-year life of his proposed contract. "Our position," says the report, "is that this (the manufacture of fertilizers) is a hollow promise made to enlist the support of the farmer and not founded on any fact either contained in the contract or existing under the contract."

American Construction Council

(*Concluded from p.* 1054)

couragement and aid in the establishment of apprenticeship systems for training building trades mechanics, mitigation of seasonal unemployment, development of means for lengthening the construction season, encouragement of local building shows, study of and support for a uniform building code, assistance in the work of simplification of variety, standardization and elimination of waste in construction.

Executive Board Action

Upon the adjournment of the meeting the executive board went into session and elected as president Franklin D. Roosevelt, of New York, formerly Assistant Secretary of the Navy, and as treasurer, John B. Larner, of Washington, president of the Washington Loan & Trust Co., and vice-president of the American Bankers Association. The remaining officers (three vice-presidents and a secretary) are to be elected at an adjourned meeting of the board to be held in New York at the end of this week.

Following its organization the board authorized the appointment of the following committees: On code of ethics, on seasonal unemployment, on apprenticeship, on building codes, on transportation rates, on publicity, on simplification, standardization and waste elimination and on methods to be pursued in gathering statistics. The personnel of these committees is to be determined later, but a general resolution declared that there should be on each committee at least one representative of each of the groups in the council.

The financing of the organization was quite fully discussed and while it was agreed to drive hard for association and sustaining members, it was felt that the magnitude of the opportunity demanded the raising of funds in excess of what can be expected from dues. It was freely expressed that the council would not be living up to its opportunities if in three years its annual budget was less than $250,000. No conclusion on the method of financing, other than by dues, was reached, but the subject was set as one of the chief items of business at the later session of the board this week.

Supreme Court Decision on Interstate Waters

Wyoming-Colorado Case Sets Up Paramount Interest of Prior Use Despite State Lines

(*Washington Correspondence*)

A decision of great importance to irrigation and power development has been rendered by the U. S. Supreme Court in the case of the State of Wyoming vs. the State of Colorado, the Greeley-Poudre Irrigation District, and the Laramie-Poudre Reservoir and Irrigation Co. The opinion has the effect of obliterating state boundaries in the matter of the use of water. States as such have no ground on which to base an appearance in court. This privilege is enjoyed, however, by any citizen of any state who considers himself aggrieved.

Under the Supreme Court's decision, it is a matter of first come first served. Any citizen regardless of the state in which he resides may put the water to use. Those putting the water to use first have a prior claim against any subsequent appropriator.

Justice Van Devanter's Opinion

Justice Van Devanter's opinion, delivered from the bench several days prior to the completion of its text, consists of 34 printed pages—an unusual length for a Supreme Court opinion. The more important pronouncements are contained in the following extracts from the decision.

"We conclude that Colorado's objections to the doctrine of appropriation as a basis of decision are not well taken, and that it furnishes the only basis which is consonant with the principles of right and equity applicable to such a controversy as this is. The cardinal rule of the doctrine is that priority of appropriation gives superiority of right. Each of these states applies and enforces this rule in her own territory, and it is the one to which intending appropriators naturally would turn for guidance. The principle on which it proceeds is not less applicable to interstate streams and controversies than to others. Both states pronounce the rule just and reasonable as applied to the natural conditions in that region; and to prevent any departure from it the people of both incorporated it into their constitutions. It originated in the customs and usages of the people before either state came into existence, and the courts of both hold that their constitutional provisions are to be taken as recognizing the prior usage rather than as creating a new rule. These considerations persuade us that its application to such a controversy as is here presented cannot be other than eminently just and equitable to all concerned.

"In suits between appropriators from the same stream, but in different states recognizing the doctrine of appropriation, the question whether rights under such appropriations should be judged by the rule of priority has been considered by several courts, state and federal, and has been uniformly answered in the affirmative. . . . These decisions, although given in suits between individuals, tend strongly to support our conclusion, for they show that by common usage, as also by judicial pronouncement, the rule of priority is regarded in such states as having the same application to a stream flowing from one of them to another that it has to streams wholly within one of them.

"The contention of Colorado that she as a state rightfully may divert and use, as she may chose, the waters flowing within her boundaries in this interstate stream, regardless of any prejudice that this may work to others having rights in the stream below her boundary, cannot be maintained. The river throughout its course in both states is but a single stream wherein each state has an interest which should be respected by the other."

Decision Reverses Colorado Theory

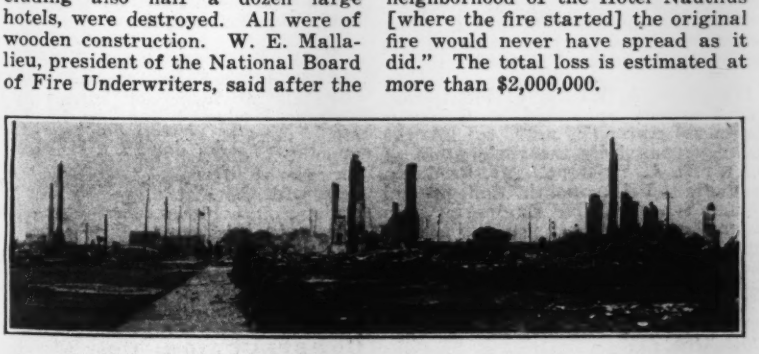
The decision is a complete reversal of the Colorado theory. The position of Colorado, deduced from the decision in the case of Kansas vs. Colorado, is that it is the keystone of the arch. Since most of the water in the Colorado River falls on watersheds within the State of Colorado, it has attempted to establish a prior claim on any water originating in Colorado whether or not it was put to use in that state. Since the waters of the Colorado will be appropriated and put to use faster in the lower basin of the river than in the upper basin, it will mean that Colorado must do nothing which interferes with those entitled to priority in the use of the river's water.

In view of the Supreme Court decision, it is believed that greatest activity will be brought about along the entire Colorado in the effort to establish prior use. One of the fortunate features of the situation is that there is a great abundance of water. While it is assumed that the state laws will govern in giving irrigation the right to use the water before it is used for power purposes, the prior rights already established in the Imperial Valley and in other sections on the lower Colorado will require such a volume of water as to insure the development of large amounts of power in the Canyon sections of the river.

Secretary Hoover stated on June 13 that the decision has simplified greatly the task before the Colorado River Commission. The decision will add greatly to interest in the hearing to be conducted at Santa Fe on Aug. 1. At that hearing suggestions undoubtedly will be made for procedure in establishing prior rights.

Large Area of Wooden Dwellings Destroyed by Fire

Part of Arverne, a residential district on Rockaway Beach, New York City, was swept by fire on the evening of June 15. About 150 buildings, chiefly dwellings but including also half a dozen large hotels, were destroyed. All were of wooden construction. W. E. Mallalieu, president of the National Board of Fire Underwriters, said after the fire, "The Arverne fire was what is known as a wooden shingle roof conflagration. It is probable that if there had been no wooden shingle roofs in Arverne in the immediate neighborhood of the Hotel Nautilus [where the fire started] the original fire would never have spread as it did." The total loss is estimated at more than $2,000,000.



Attack Federal Water Power Act in Supreme Court

Permission to file an original bill against the Federal Power Commission has been granted by the U. S. Supreme Court to Attorney General Newton on behalf of the State of New York, who contends that the federal water power law is inapplicable to waters in that state on the ground that the government's jurisdiction extends to such waters in so far only as navigation is concerned. The argument and decision will not be had until after the next term begins in October.

The New York authorities seek to prevent the Federal Power Commission from enforcing the law in New York, on the ground that New York is entitled to control water powers within the state. It is contended in the brief of the Attorney General accompanying the motion that the federal water power act is invalid, unconstitutional and void, and not enforceable in New York. It is argued that the federal act interferes with the rights, powers and duties of the state. For the state it is contended that it has all power over waters in the state, including the development and use of water powers, and that government jurisdiction extends only over navigation questions.

It is contended that the federal power commission should not have authority to regulate and control rates for the sale of electric power developed under water power projects when such sales are intra-state and not related to navigation. The state also seeks to prevent the federal power commission from designating what licenses shall be granted for water power development.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Annual Meeting, Atlantic City, N. J., June 26-30.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston; Annual Convention, New Bedford, Mass., Sept. 12-15.

The Cleveland Engineering Society, in connection with its annual meeting held last week, made an all-day inspection of the public works in the city. Among the places visited were the pumping station, filtration plant, sewage-treatment works, Fairmount and Baldwin reservoirs, the municipal bath house and the municipal light plant.

The Cincinnati Section of the American Society of Mechanical Engineers and the **Cincinnati Engineers' Club** held a joint meeting recently. Dean M. E. Cooley, president of the Federated American Engineering Societies, was the principal speaker.

The San Francisco Post of the Society of American Military Engineers had as its chief speaker recently Frank G. White, chief engineer, state harbor commission, who spoke upon "Harbors and Terminals: The Port Facilities of San Francisco Bay."

The West Australian Branch of the Australian Institution of Engineers has elected the following as officers for 1922-1923: Chairman, W. H. Shields; vice-chairman, T. M. Carey; secretary, Assistant Prof. Tomlinson, and treasurer, J. Andrews. On the committee are R. H. J. Clarke, A. W. Galbraith, H. T. Haynes, P. V. O'Brien, J. Parr, and W. K. Weller.

Personal Notes

A. C. GODWARD, engineer for the Minneapolis Board of Park Commissioners, has been appointed engineer for the recently created Minneapolis City Planning Commission. He will continue for several months with the Park Board with which he has been for 15 years, and will then give full time to the new work.

J. S. WILSON has opened a civil engineering office in Bailey, N. C., where he will specialize in municipal consulting work and in land surveying and subdivision work.

H. H. DOLBY has been appointed chief engineer of all the Vacarro Bros. railroads in Honduras. He succeeds H. J. Hill, who resigned because of ill health and who has returned to his home in Ohio. Mr. Dolby has been locating engineer in Honduras doing railroad work for the United Fruit Co. and other organizations.

H. I. BENJAMIN, formerly office engineer in the maintenance-of-way department in the San Francisco offices of the Southern Pacific Co., has been promoted to the position of assistant division engineer of the Portland division with headquarters at Portland, Ore. H. MARSHALL will succeed Mr. Benjamin. The appointments were effective June 1.

FREDERICK L. FORD, city engineer of New Haven, Conn., has been appointed by Governor Lake one of six members of a commission from that state which, with similar commissions from the other New England States, will work out a plan for consolidating New England's railroads into one compact system. Mr. Ford was for fifteen years in the city engineering department of Hartford, resigning his position as city engineer in 1911 to enter private practice. A year later he was made city engineer of New Haven.

GEORGE A. REED, of Montpelier, Vt., has been appointed by Governor Hartness state engineer to fill the vacancy caused by the resignation of DANIEL A. YOUNG. Mr. Reed is a graduate of Dartmouth College and Thayer School of Civil Enginering, and his professional experience has included the positions of city engineer of Barre and of Montpelier, Vt., and assistant state engineer of Vermont, and service with the United States Reclamation Service in irrigation work in Klamath Falls, Ore.

J. W. DEER, formerly an officer of the American Sewer & Drain Construction Co. is now associated as president with the American Engineering and Construction Co., Chicago. This firm specializes in the design and construction of sewers, sewage-disposal plants, water-works and tunnels.

J. L. PERRON has been appointed minister of roads for the Province of Quebec. Other changes include the appointment of JOSEPH BOULANGER as deputy minister to replace B. Michaud, and the appointment of G. HENRY, formerly chief engineer of the department, as consulting engineer.

L. S. TRAINOR has been appointed district engineer in charge of the Illinois district of the Portland Cement Association, to succeed C. M. POWELL, resigned. Mr. Trainor has been with the association for the past three years, located principally in southern Illinois. Prior to joining the association's staff he was superintendent of highways of Marion County and city engineer of Centralia, Ill.

CHARLES H. ENSIGN has resigned from the staff of the New York Central R.R. to accept the position of field engineer with the George S. Rider Co., consulting engineers, Cleveland. For the past five and a half years Mr. Ensign has been assistant engineer in the valuation department of the New York Central at Cleveland.

C. G. ADSIT, executive engineer, has been elected by the board of directors a vice-president of the Georgia Railway & Power Co. Mr. Adsit, who is also a director of the company, became connected with the company in 1911 as resident engineer on the Tallulah Falls hydro-electric development. Later he was made chief engineer, then consulting engineer.

JOSEPH B. GUNNISON, formerly of the White Construction Co., Inc., New York City, has gone into the general contracting business for himself under the firm name of the Gunnison Construction Co. His offices are in New York City.

Business Notes

C. J. BRENDER, for the past ten years mechanical inspector for the Jones & Lamson Machine Co., Springfield, Vt., has resigned.

THE PITTSBURGH TESTING LABORATORY has opened a sales office and an inspection bureau in the Railway Exchange Building, St. Louis, Mo. Col. N. C. Hoyles has been appointed district manager. Except for service overseas Col. Hoyles has been with the Pittsburgh Testing Laboratory since his graduation from the University of Toronto. Since the war he has been assistant sales manager at New York and manager of the Cincinnati branch.

THE WOODWARD-REPUBLIC CONSTRUCTION CO., Cleveland,

Ohio, has been organized to do general engineering and construction work.

ELLERY, FROST & PATTEN, San Francisco engineers, have opened a branch office in Fresno, Cal. The new office is in charge of BYRON T. PATTEN.

LANGTHORN & SMITH, Inc., New York City engineers and builders, announce their incorporation to carry on the building business formerly conducted by C. H. Smith.

THE TITAN IRON & STEEL Co., Inc., Newark, N. J., manufacturers of mechanically-puddled wrought iron, announce the appointment of W. Woodward Williams as vice-president. Since his graduation from Harvard in 1905 Mr. Williams has successively filled important executive positions with the Bourne-Fuller Co., Cleveland, the A. M. Byers Co., Pittsburgh, the Reading Iron Co., and the Pittsburgh Gage & Supply Co.

THE CLEVELAND TRACTOR Co., makers of Cletracs, will be reorganized as the ALLYNE-ZEDER MOTORS CO. to manufacture and market the new six cylinder car which is being designed by F. M. Zeder, formerly chief engineer of the Willys Corp. and the Studebaker Corp. The reorganization will be brought about by adding approximately $5,000,000 of new capital to the present assets of the Cleveland Tractor Co., resulting in a corporation with a capital of $10,000,000 of preferred stock and 200,000 shares of no par common stock. A new corporation subsidiary to the Allyne-Zeder Motors Co. will be organized under the name of the CLEVELAND TRACTOR CO. and will continue the marketing of Cletracs through its present distributors and dealers. A new 1-ton truck will be added to the Cletrac line. For the Allyne-Zeder Co. Clement Studebaker will be chairman of the board and Rollin H. White, president. R. T. Hodgkins, general sales manager of the Cleveland Tractor Co., is a vice-president of the new corporation.

OBITUARY

CAPT. A. L. RUSSELL, civil engineer and Dominion land surveyor, formerly of Port Arthur, Ont., Canada, died June 11 in Ottawa, aged 80 years.

JAMES E. MCNEIL, for 35 years a construction engineer for the Atchison, Topeka & Santa Fe R.R., died at his home in Los Angeles, Cal., May 28, aged 75 years.

MILO A. ADAMS, head of the firm of M. A. Adams & Co., Minneapolis, for many years engaged in bridge building in the Northwest, died June 11 aged 74 years. Mr. Adams was actively engaged in construction work up to the time of his death.

J. C. O'DONNELL, general superintendent of the Canadian National Lines, maritime district, died in Moncton June 55. Prior to going to Moncton, Mr. O'Donnell was located at Winnipeg, being superintendent of the Edmonton, Saskatoon and Winnipeg branch of the Canadian Northern.

JOSEPH B. WAUD, for many years surveyor and engineer for Ventura County, Cal., died at his home there June 1.

CAPT. ALBERT DE RUIZ, who served for 12 years as city engineer of Long Beach, Cal., retiring a year ago, died at his home in that city on May 29, aged 69 years. He was born in Havana, Cuba, and was graduated at the United States Naval Academy in the class of 1875, serving for 10 years as a naval officer.

HENRY L. KREUSLER, building contractor and banker of Pittsburgh, died recently at Saranac Lake, N. Y., aged 61. Since 1886 he has been head of the Building Construction Co.

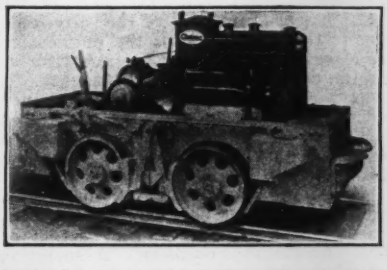
JAMES F. INGRAM, for more than half a century superintendent of bridges and buildings for the Louisville and Nashville R.R., died recently in Louisville, Ky., aged 87 years. He retired from active work about ten years ago.

CORNELIUS VAN VORST POWERS, chief of one of the bureaus of the New York Transit Commission and former division engineer of the commission, died in New York City June 18, aged 62 years. Mr. Powers was graduated from the School of Mines of Columbia College in 1882. From 1885 to 1900 he was employed by the New Croton Aqueduct Commission in various engineering capacities. He joined the engineering staff of the Rapid Transit Commission in 1900 and had much to do with the construction of the New York subway system.

EQUIPMENT AND MATERIALS

Combination Industrial Locomotive

A new use for a tractor power plant is illustrated in the accompanying picture of a new light industrial locomotive just announced by the Atlas Car & Manufacturing Co. of Cleveland. The Model F Cletrac made by the Cleveland



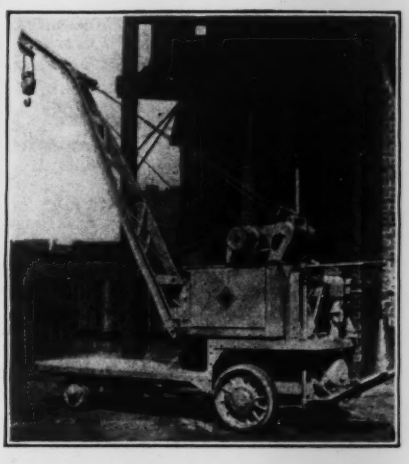
Tractor Co., minus its side frames, tracks, seat and steering wheel is set bodily into the frame. The unit is designed particularly for road construction, industrial railways and general plant hauling.

Waterproof Cement Paint

The Sandusky Cement Co., Cleveland, Ohio, has recently placed upon the market a new product, Medusa waterproof cement paint which, it is claimed, is unaffected either by lime and alkalies present in portland cement or by moisture which causes deterioration of oil paints. The paint may be applied to any masonry surface, even when wet, and is designed to bond with such surfaces. The paint comes in the form of a dry powder to be mixed with water and the colors available at present are white, cream-buff, and stone gray, with others forthcoming. One pound of the dry paint, mixed according to specifications, will cover from 12 to 15 sq.ft. of surface, according to the manufacturers.

Electric Industrial Crane Truck

A low revolving and luffing electric crane, mounted on an electric industrial load-carrying truck, has been developed by the Elwell-Parker Electric Co., Cleveland. The unit is especially designed for inside work, although it may be used for outdoor service. Its lift capacity is 3,000 lb. at 6 ft. and 1,000 lb. at 12-ft. radius, without out-



riggers. A new design of single-motor, double-drum hoist unit handles a separate line to the boom and hook. The motor hoist unit, with battery, forms a counterbalance for the 12-ft. boom with load. A single battery furnishes propelling and hoisting power. The manufacturers claim that this is the largest capacity electric industrial crane truck built.

Out-of-the-Ordinary Trade Publications

THE SULLIVAN MACHINERY Co., Chicago, has issued two bulletins, the first No. 77-D, dealing with portable air compressors of three types, including gasoline-engine driven, belt driven from an electric motor, and belt driven from a tractor. These outfits are intended for rock removal in road-building or in city streets. The other bulletin, 70-X, describes a compressed-air spader or pneumatic clay-digging tool in the form of a light air hammer weighing 16 lb. designed to take the place of a hand pick and shovel.

In a 28-page illustrated booklet the PROTEXOL CORP., successor to the Carbolineum Wood Preserving Co., New York, publishes a list of authenticated specimens of wood preservation and a discussion of the general subject of timber treating by E. F. Paddock, chemical engineer. Charts and tables of cost data are included.

Business Side of Construction

Facts and Events that Affect Cost and Volume

Debits to Individual Accounts Measure General Business Activity

Index Maintained by the Federal Reserve Banks Gives Good Indication of Industrial Trend

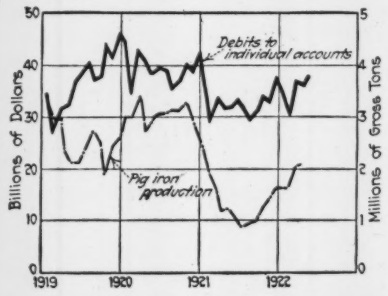
A corporation recently requested the Business Side of Construction to suggest a good curve showing general business activity, against which its own business might be plotted. Bank clearings were the first thought, but still better is the aggregate of checks drawn by individuals on their bank accounts. The following paragraphs explain this comparatively new barometer for the benefit of construction and manufacturing companies which might wish to check their individual activities against the swing of general business.

One of the major questions in the construction industry is whether the boom in building operations, which has raised the volume for contracts let for new construction to record figures in the early months of this year, is a temporary spurt, resulting from a great housing shortage, or whether it is destined to continue in heavy volume for some months to come. Some light on this question would be shed by any index which would show accurately changes in the volume of general business activity throughout the country. For in times past it has been rather clearly demonstrated that a genuine recovery in the construction industry usually accompanies a general recovery in business as a whole. For this reason, members of the construction industry should be interested in an index of business conditions which is being carried forward currently by the Federal Reserve banks and the Federal Reserve Board.

Debits Better Than Bank Clearances

This index of business conditions is not called by that name, but goes under the somewhat academic title, "Debits to Individual Accounts." To paraphrase this expression in more ordinary language, it means the checks drawn by individuals on their bank accounts. Somewhat similar figures have been available for a great many years in the form of bank clearings. For many years economists and business men have found the volume of business done by banks as represented by the checks passing through clearing houses an excellent indication of the degree of business activity in the country. These newer figures of debits to individual accounts are simply a refinement of the old clearing figures.

There were several difficulties with the clearing figures which made it desirable to find some more precise measure. The clearing figures, in the first place, represented simply the amount of checks which were sent through clearing houses in different centers, and they did not include checks presented for payment at the banks on which they were drawn. In the second place, there was found a considerable amount of duplication in the clearing figures, because very frequently a check would pass through two or more clearing houses and would be counted two or more times when the figures for several clearing houses were added together. While such difficulties as these did not prevent the clearing figures from being a good index of the general swing of business conditions, they made the figures frequently misleading as far as individual cities were concerned. For example, there has been in recent years a marked tendency toward the consolidation of big banks. Before a consolidation any checks passing between two banks go through the clearing houses; after the consolidation this clearing operation is eliminated, although the amount of business done through the two banks is exactly the same. It is clear that a consolidation of this sort would have an appreciable effect in decreasing the volume of clearings in any



city. In St. Louis the reflection in clearing figures of just such a consolidation was reported as the underlying reason for the movement on the part of the Chamber of Commerce of that city looking to the suspension of the publication of clearing figures and the substitution of the debits to individual accounts. It was asserted that a false impression of the business of the city was given by the clearing figures. Changes such as this would have no effect on figures for debits to individual accounts.

The idea of substituting debits for clearings is not a new one. As far back as 1908 the clearing house section of the American Bankers' Association adopted a resolution recommending that the record of bank debits be kept instead of clearings, as a better means of determining the volume of business transacted. In 1913 some clearing houses began to report debits but it was not until 1916 that the figures of a sufficient number were available to warrant publication. In 1918 the Federal Reserve Board began to compile the debit figures. and since then these figures have been of increasing value until now they are regarded as an authoritative barometer of business conditions. Last year, at the American Bankers' Association convention in Los Angeles, the clearing house section adopted a resolution to the effect that the publication of clearing figures be abolished and those of the debits substituted.

There are now 243 clearing houses, situated in different parts of the country, which collect and forward the debit figures. The banks which are members of a clearing house total their six daily figures of each week and furnish them to the manager of their clearing house who in turn sends them at the expense of the Federal Reserve Board to the Reserve Bank of the district in which the clearing house is located. The Federal Reserve Bank, after tabulating the figures and checking up the number of reporting banks so as to insure comparability, forwards the totals for each clearing center to the Federal Reserve Board at Washington. There the figures are assembled for publication weekly in the consolidated press statement.

The reporting week covers the period from Thursday morning to the close of business on the following Wednesday, and the Board publishes monthly in the *Bulletin* the weekly totals for the month. The figures for the corresponding weeks of the preceding year are also shown. Although the Board, beginning Jan. 1, 1922, has been publishing figures from 243 clearing centers, the figures for only 166 of these centers are available for last year; and, therefore, in its summaries for last year and this year, the Board contrasts the figures of only the 166 centers, in order to maintain a strict comparison. The centers now reporting, it is estimated, handle between 75 and 85 per cent of the total clearings of the country.

What the Debit Figures Include

The debits reported are those to the accounts of individuals, firms, corporations, and the United States Government, including the debits to the war loan deposit account and against savings accounts, payments from trust accounts and of certificates of deposits, and cashier and treasurer checks issued by a firm or corporation. They exclude all debits to bank accounts, cashier and treasurer checks issued by a bank, debits in settlement of clearing house balances, charges to expense and miscellaneous accounts, and corrections and similar charges. Irrelevant material is eliminated and only actual business transactions are represented.

In the diagram on this page the solid line represents the debits to individual accounts from the beginning of 1919 to date, and there has been added a broken line showing pig iron production during the same period. This comparison is interesting because the production of pig iron, involving as it does such a multiplicity of products, follows closely the trend of general business activity.

The figures for debits represent a still wider range of activity as they reflect retail and wholesale transactions and wage and interest payments as well as transactions connected with production. They come nearer to measuring the entire business of the country and fluctuate less than pig iron production.

Their fluctuation would be still less than that shown in the diagram if allowance could be made for the changes in prices in the three years.

Both lines reflect in their movement seasonal influences which obscure somewhat the general trend. During the first months of each year, following the stimulus due to holiday buying, there is a distinct falling off in the volume of debits. About the third month there is an improvement, succeeded by another decline until the late summer. Then, coincident with the marketing of the crops, the debits increase until they reach their peak at the holiday season at the end of the year. The seasonal movement is somewhat less marked in the case of pig iron.

Although representing different phases of business activity, the two lines show a similar trend, excepting in 1919 when the curtailment of production in the pig iron industry, due to strikes, caused a downward movement in the line of pig iron. Debits at that time were increasing, reflecting trade expansion. Beginning with 1920 the two lines show a decline which followed the lessening demands of business, until in the late summer of 1921 they touched the lowest point. Since then, the rise in both lines indicates the substantial basis for the recent building activity.

Brick Prices at Yard and Delivered

Some idea of the relation between brick prices at the yard, f.o.b. city or delivered on the job may be had by comparing *Engineering News-Record's* quotations with those in the table compiled by the Common Brick Manufacturers' Association. The range at the various yards has widened a dollar or so in the last few months; that is, the minimum quotation is slightly lower, and the maximum a little higher.

Prices to consumers, however, have risen sharply in certain sections. New York, of course, is a glaring example; a jump of $3.10 in one month, current delivered price being $23.50, with $20 the price alongside dock. In May price advances were as follows: Minneapolis, $1 to $2; Atlanta, $1; Birmingham, $2; Philadelphia, $1.

The prices in the table are as of May 1. In the May 4 issue of the *News-Record*, delivered prices were quoted as follows: New York, $20.40; Boston, $16; Minneapolis, $15; Montreal, $16; Detroit, $16.50; Baltimore, $20; Pittsburgh, $17.50. F.o.b. prices at other centers were: Chicago, $11; St. Louis, $14; Denver, salmon, $12; Dallas, $11.15; San Francisco, Los Angeles, Cincinnati, $15; Atlanta, $9; Birmingham, $9.50. The lowest quotations were in the South, both at the brickyards and to the contractor.

New York City still faces an acute brick situation. Building operations in this city take up all the common brick as fast as shipments can be made from four great centers of production, namely: Hudson River, Raritan, Hackensack and Connecticut. Brick men say that the shortage should not be attributed to slowing down of current production or shipments but to the fact that not enough unburned brick was reserved last Autumn to supply the demand until the new brick could be marketed.

To the price at Hudson River yards must be added the cost of towing, reaching as high as $3.43 per 1,000, resulting in a wholesale price of $20, alongside dock, New York. To the price alongside dock is added $1.50 for hauling, a dealer's profit of 10 per cent, or $2, yielding a price of $23.50 per 1,000, delivered at job in New York City.

REPORT ON COMMON BRICK FROM 99 YARDS AS OF MAY 1, 1922

Dist. No.	Including States of	No. of firms reporting	Plants Closed Down	Unburned Brick on Hand	Burned Brick on Hand	Orders on Books	Price Per Thousand At Brickyard
1.	N. Y., New England	13	6	8,795,000	3,270,000	4,827,000	$12.00 to $20.00
2.	Pa., N. J., Md., D. C. Del.	11	1	22,760,000	4,949,000	36,521,000	12.00 to 17.00
3.	Va., N. C., S. C., Ga., Fla.	5	0	3,016,000	1,249,000	2,560,000	9.00 to 16.00
4.	Mich., Ohio, W. Va.	9	2	8,741,000	2,419,000	16,304,000	10.00 to 13.25
5.	Ill., Ind., Wis.	24	1	91,091,000	1,799,000	163,869,000	10.50 to 14.50
6.	Ky., Tenn., Miss., Ala., Ark., La.	13	3	6,198,000	5,221,000	4,329,000	8.00 to 15.00
7.	N. and S. Dak., Minn., Neb. Ia., Kan., Mo.	9	1	7,015,000	850,000	1,338,000	10.50 to 16.00
8.	Okla., Tex., N. M.	8	5	10,044,000	1,442,000	6,578,000	8.50 to 13.00
9.	Wash., Ore., Mont., Wyo. Ida., Utah, Colo.	3	1	1,251,000	602,000	267,000	13.50 to 15.00
10.	Calif., Ariz., Nev.	4	0	1,775,000	5,918,000	14,045,000	14.00 to 15.50
	Total	99	20	160,686,000	27,719,000	250,638,000	

May Fabricated Steel Sales at 82 Per Cent of Capacity

Sales of fabricated structural steel during May amounted to 82 per cent of fabricating capacity, according to reports made to the Department of Commerce by firms comprising 70 per cent of the fabricating capacity of the United States. The May business reported by 82 firms, having a capacity of 130,600 tons, totaled 106,620 tons as against April sales of these same firms amounting to 121,211 tons, or at the rate of 93 per cent of capacity.

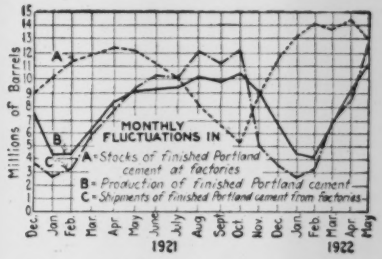
Total sales throughout the United States, based on the reported percentage and a total capacity of 180,000 tons, amounted to 146,900 tons in May, with 165,900 tons in April.

Chicago's Building Boom

During May the total value of buildings for which permits were taken out at Chicago was $27,029,650, which is said to be nearly $4,000,000 more than the previous high monthly record. These permits provide for 635 single residences and 371 apartment buildings, most of the latter being of large size. A statement issued by the Citizens' Committee for enforcing the Landis award states that the May permits bring the grand total for 1922 to 11,035 new homes under construction or contemplated in the near future, while the city's original housing shortage was estimated at 4,000 homes.

Heavy Gain in Cement Production in May

May figures for cement production, recently released by the Geological Survey, show an increase of 1,895,000 bbl. over May, 1921, while shipments were 3,261,000 bbl. heavier. Stocks are 1,643,000 bbl. lower than at the end of April, but 447,000 bbl. larger than a year ago. May exports and imports


Millions of Barrels
MONTHLY FLUCTUATIONS IN
A-Stocks of finished Portland cement at factories
B-Production of finished Portland cement
C-Shipments of finished Portland cement from factories
Dec. Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May
1921
1922

of hydraulic cement are not yet available. April imports were 10,855 bbl., against 1,597 in March; exports amounted to 75,412 bbl., against 103,556 in March.

Federal-Aid Road Bids Lower Throughout United States

A considerably lower level of prices for the various items entering into highway construction is reported by the Bureau of Public Roads of the United States Department of Agriculture. This conclusion is based on the following prices by successful bidders on Federal-aid roads during April and are averaged for the whole of the United States. Some of the figures cover a large volume of work well distributed over the country, while others are based either on small volumes or scattering reports.

The figures which cover the cost in place are as follows: Earth excavation, common, 33 cents a cubic yard; rock excavation, $1.26 a cubic yard; gravel, $1.44 a cubic yard; sand-clay, 45 cents a cubic yard; crushed stone, $3.42 a cubic yard; structural concrete of various classes ranges from $14 to $21.20 a cubic yard. For surfacing the following are the prices by the square yard: Gravel, 40 cents; surface-treated macadam, 50 cents; bituminous macadam, $1.06; bituminous concrete, $1.97; plain cement concrete, $2.17; reinforced cement concrete, $2.54; and brick, $3.70. Reinforcing steel has cost $0.053 a pound and structural steel $0.059 a pound. Cement has been furnished to contractors by the following States at the prices given by the barrel: New York, $1.73; Wisconsin, $1.94; and Arkansas, $2.70.

Freight Loadings Decrease 70,476 Cars in Week

Loadings of revenue freight during the week ending June 3 totaled 750,645 cars, compared with 821,121 cars during the previous week, a decrease of 70,476 cars, according to the Car Service Division of the American Railway Association. The reduction was due to the holiday, May 30. This was 50,742 cars more than in the corresponding week last year.

Coal loadings amounted to 86,626 cars, a decrease of 4,744 compared with the previous week. Coke, with a total of 8,927 cars shows an increase of 76 cars over the week before. Ore load-

ings continue to increase, the total for the week being 31,552 cars, a gain of 7,681 over the preceding week. Forest products, with a total of 58,923 cars, showed a decrease of 5,097, under the week ending May 27.

Cars idle because of business conditions numbered 480,266 on May 31, compared with 504,702 on May 23, or a reduction of 24,436 cars. Of the total, 305,198 cars were surplus freight cars in good repair and in excess of current freight requirements, while the remaining 175,068 were disabled freight cars in excess of the normal number unfit for service.

Surplus coal cars in good condition numbered 195,439, a reduction of 13,252 since May 23, surplus box cars in good repair totaled 69,714, a reduction of 9,820 in the same period.

Commerce Dept. Shows Business Conditions by Ratio Charts

A series of charts plotted to logarithmic scale in order to permit direct comparison of percentage changes in index numbers has been incorporated in the Monthly Survey of Current Business, published by the United States Department of Commerce as a supplement to *Commerce Reports*. The diagrams in the May issue show for the years 1920, 1921, and for the first three months of 1922, the variation of the index numbers for pig iron production, bituminous coal production, cotton consumption, freight ton-miles, export values, bank clearings outside New York City, liabilities, wholesale prices, and industrial-stock prices.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted. Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section. The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of June 1; the next, on July 6.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$2.68	$3.50	$4.00	$2.48	$2.86	+$3.60	$3.10	$3.60	$3.75
Structural rivets, 100 lb.	3.60	4.25	5.50	3.10	3.90	4.45	4.25	3.75	6.50
Reinforcing bars, ¾ in. up, 100 lb.	2.58	3.50	3.50	2.38	2.76	+3.67½	2.55	3.60	+2.90
Steel pipe, black, 2½ to 6 in. lap, discount	61%	61.15%	45%	59½%	61.9-5%	44%	49.1%	53%	30.00
Cast-iron pipe, 6 in. and over, ton	48.80@49.80	48.50	+51.50	44.10	50.50	57.00	51.00	+53.00	50.00
Concreting Material:									
Cement without bags, bbl.	2.40@2.50	2.34	2.25	2.07	2.34	2.90	2.83	2.94	2.48
Gravel, ¾ in., cu.yd.	1.75	1.85	2.25	1.80	1.50	1.75	2.25	1.25	1.50
Sand, cu.yd.	1.00	1.15	2.25	1.80	1.00	0.75	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd.	1.75	1.90	2.73	1.60	2.25	3.50	2.25	3.00	2.00
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	49.00	+39.00	+38.00	45.00	40.00	49.00	25.00	21.50	82.00
Lime, finishing, hydrated, ton	15.80@16.80	22.50	25.00	18.00	29.00	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	2.75@3.18	1.75	2.50	1.40	1.40	2.70	1.75	2.80	11.00
Common brick, delivered, 1,000.	23.50	10.00	11.15	11.00	16@17	12.00	15.00	14.00	16.00
Hollow building tile, 4x12x12, per block	Not used	.075	.115	.0707	.082	.08	....	.12	09
Hollow partition tile 4x12x12, per block	.1112	.0707	.115	.0657	....	.08	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.86	.92	—1.07	.96	.98	—1.08	1.04	.86	+1.09
Common Labor:									
Common labor, union, hour	.75	.35	.....	.80	.....	.50 @.55	.56¼	.50@.60	....
Common labor, non-union, hour.	.44@.60	.20	25	72½	.35@.50	.35@.50	.47½@.50	.....	.20@.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed store quoted at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.55 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir common.

Seattle quotes on Douglas fir instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks.

Montreal quotes on long-leaf yellow pine, short-leaf, $67.50. Sand, stone, gravel and lump lime per ton. Lime and tile are delivered; cement, sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.10 cents). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $30; 6-in., $110.

Changes Since Last Week

Advance in price of structural steel, effective last week in New York and Minneapolis warehouses, is followed by a similar advance this week, in Denver, where steel shapes are quoted at $3.60 as against $3.50 and reinforcing bars, $3.67½ as compared with $3.52½; mill shipments of structural shapes, $3 per 100 lb., f.o.b. Denver. Mill price of reinforcing bars, $1.70 Pittsburgh, with structural shapes nearing that figure. Quotations on shapes, plates and bars range between $1.60 and $1.75 per 100 lb.

Increased cast-iron pipe quotations are charged to higher fuel prices. Dallas quotes $51.50 as against $48.30, and Seattle $53 as compared with $52 per ton, last week.

Concreting materials remain firm throughout the country with no price changes. Long-leaf yellow pine continues to rise. Atlanta quotes $39, advanced from $38, and Dallas, $38, against $34.50 per M ft. b.m.

Raw linseed oil in Montreal quoted at $1.09 as against $1.07. Dallas reports $1.07, down from $1.09; Denver, $1.08, in wooden barrels, reduced from $1.10 and $1.06 in iron containers.

Reports from Seattle announce a general wage advance of 5c. per hr. in the Northwestern lumber mills. Wage increases bringing the common labor rate to 25c. per hr. have been effected in certain Southern steel mills.